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EARLY MAN

Winter 1982

Magazine of Modern Archeology

Volume 4, Number 4



**Florida's
Wet Sites:
Where the
fragile past
survives**

Plus:

Managing Arizona's Scarce Water: The Hohokam Experience
China: The People's Archeology
Opportunities for You in Archeology in 1983

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Letter from the Publisher

Looking over this and earlier issues of Early Man, I couldn't help but glory at the richness and variety of archeology in the Americas: farmers building great canals spanning miles of the central Arizona desert . . . grieved Floridians placing the bodies of their people on wooden platforms above the swamp waters, guarded by carved totemic animals . . . English traders in canoes packed with Chinese porcelains docking at a fort in northern Michigan . . . Spanish ships strewn on Caribbean reefs, time capsules on the economics and politics of a people living 1,500 miles to the east . . . the melding of religious symbolism between invading Maya-related peoples and local Mexicans a thousand years ago displayed in six incredible murals near Mexico City . . . teeth that tell us at least three waves of people—the first Americans—arrived across the Bering Straits from Mongolia and northern China beginning 20,000 or more years ago . . .

The controversies in archeology rage on: Wilburn Cockrell's struggle to control the politically-powerful looters mining the seas for salable artifacts along Florida's coasts . . . beleaguered federal rangers attempting to stop the pillaging of pueblo ruins recently opened to pot-digging by road systems built by energy companies in southwestern Colorado . . . archeologists, preservationists, citizens and congressmen gathering to tell President Reagan that eliminating federal funds for archeological preservation in all 50 states is not conscionable . . .

It is difficult for us to imagine the incredibly varied picture of human endeavor—then and now—archeology reveals as it digs into ruins from Tierra del Fuego to the Arctic seas. It is our way, we late 20th century Americans, at looking into ourselves from a viewpoint that no "relevant" experience in today's life-way can duplicate.

Let us continue to dig . . . and to tell the story.

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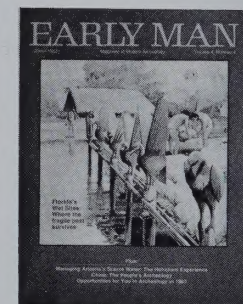
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EARLY MAN is published quarterly by the CENTER FOR AMERICAN ARCHEOLOGY (formerly Foundation for Illinois Archeology), which conducts a program of archeological research and teaching in association with Northwestern University. A subscription to EARLY MAN is included in the benefits to those who become members of the Center for American Archeology. Memberships range from \$15 to \$100. Non-members can subscribe to EARLY MAN for \$15. Annual subscription rate for archeological professionals is \$12.

Center for American Archeology
1911 Ridge Ave.
Evanston, Illinois 60201
Tel: (312) 492-5300

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On our cover:

Based on wooden carvings and other perishable evidence preserved in muck at the Fort Center site near Lake Okeechobee, artist Gordon Miller reconstructs a charnel pond as it existed there almost 2,000 years ago. The story of Florida's past preserved in wood, fiber and other fragile materials begins on page 4.

News & Discoveries

Compiled and written by Kathryn Bard

A crushing deepfreeze

Archeologists find intact Eskimo bodies over 150 years old

In the early 19th century, an Inupiat Eskimo family of seven lay sleeping in their sod and driftwood house near Barrow, Alaska, overlooking the Arctic Ocean. Without warning, a huge mass of ice was forced up the bluff and came crashing down on the house. All seven were killed and remained covered by debris until a pothunter dug into the site in 1982 and found two intact feet.

Archeologist Albert Dekin of State University of New York, Binghamton, who had been working in Barrow for two summers in advance of construction of gas distribution lines, was called in to excavate the crushed house. Two frozen intact bodies of Eskimo women were found in such good preservation that skin swirls and toenails could be discerned. The skeletal remains of five other individuals were also excavated from the main room of the house, with the kitchen and tunnel entrance left to be dug this coming summer.

The site is important because it dates to the period before major cultural changes resulted from contact with Western whalers. No articles of Western manufacture were found with the seven bodies, and the remains represent a way of life present in the Arctic for 4,000 years.

Among the artifacts found were clothing of sealskin and polar bear fur, and wooden buckets with food remains.

Autopsies in Fairbanks of the two frozen bodies re-

vealed lungs heavily pigmented with soot, caused by confinement in a small space heated by seal-oil lamps. Samples were taken from the bodies for various tests, after which the remains were re-buried in Barrow.

Romans in the New World?

Six jars, possibly Roman, found in Rio de Janeiro bay

Six tall jars resembling Roman amphoras made on the Atlantic coast of Morocco in the second and third centuries A.D. have been found in the muddy waters of Guanabara Bay, 15 miles from Rio de Janeiro. Robert Marx of Phoenician Explorations, a private firm based in Florida that conducts underwater expeditions, is currently searching for further evidence to

verify the finds as Roman.

Marx found the amphoras about five feet below the floor of the bay. He believes that a Roman ship may have been blown off course to what is now Brazil, and then was navigated through the narrow entrance into Guanabara Bay.

Although Marx has yet to excavate, his surveys of the site reveal that it is covered with sherds of amphora-type pottery, and he says sonar probing reveals the presence under the sea floor of two sections of a wooden ship. Excavation of the ship's planking will settle whether or not the ship is Roman.

Records exist of Romans circumnavigating Africa, but are lacking for any voyages in the Atlantic. Lionel Casson, an expert on ancient navigation at New York University, sees no reason why a Roman vessel caught by a storm off Morocco could not have been

blown across the Atlantic.

To aid in resolving speculation on such a voyage, scientific tests can be done to determine the nature of the clay used in the manufacture of the jars. Elizabeth Lyding Will in the Classics Department at the University of Massachusetts, an expert on Roman shipping jars, has not examined any of the pottery yet, but observes from photographs that the shape of the jars Marx found is similar to Roman amphoras produced on the west coast of Morocco and used as containers for a fish sauce highly prized as a condiment throughout the Roman empire. Marx, who has worked many Spanish wrecks in Caribbean waters, seems certain that the jars are not Spanish because they have handles.

Reburial an issue in California again

New state law poses a threat to effective archeological research

On January 1, a new law went into effect in California giving Native Americans the power to determine the fate of any excavated skeletal remains and artifacts associated with them. Furthermore, after 1984, no one—including educational and research institutions—can obtain or possess human remains or associated artifacts from any "Native American" burials in California. "Archeology is legislated out of business in California by this law for all practical purposes," archeologist Clement Meighan at UCLA told *Early Man*.

The new law requires that archeologists cease work im-



Robert Marx with jars from a shipwreck in Rio de Janeiro bay which he believes is Roman.

Photo: Robert Marx

News & Discoveries

mediately upon finding human remains and contact the local coroner, who determines the likelihood of a modern homicide. Then the matter is transferred to the Native American Heritage Commission in Sacramento, which appoints an Indian group to determine the fate of the bones. All archeological work stops indefinitely.

Archeologist Michael Moratto of INFOTEC Development, Inc., in Sonora says: "The law is so flawed that it cannot possibly stand up to legal challenges. Since most ancient peoples in California buried their dead within occupation sites and not in discrete cemeteries, the law will affect most archeological sites that are found."

Alternatively, the new law could give land developers a way of escaping from archeological requirements otherwise imposed on them, says archeologist Tom King of the Advisory Council on Historic Preservation, because it will be much easier to apply to archeological discoveries than to the destruction of burials during land development. The new law appears to conflict with federal laws and regulations which seek to strike a balance between the cultural interests of living populations and research interests of archeologists.

In response to the new law, the American Committee for Preservation of Archeological Collections, a group of more than 400 archeologists from throughout the U.S., has been formed to protect archeological materials in California. The committee is fighting the new law in court to prevent already existing collections from being destroyed.



A drilled abscessed tooth from a male skeleton in a cemetery in Illinois dating to around A.D. 1100 is evidence for prehistoric dentistry.

Photo: Della Collins Cook

Kansas earthwork of serpent shape

160-foot-long depression may have been used in marking change of seasons

On a prominent ridge in south-central Kansas near the headwaters of the Little Arkansas River, a 160-foot-long depression has been discovered in the shape of a coiled serpent holding a round object between its open jaws. What this strange figure represents is gradually being unravelled by archeologist Clark Mallam of Luther College in Decorah, Iowa.

For years a farmer near Lyons had observed the depression in his pasture and pondered why only buffalo grass grew there. The farmer eventually contacted Mallam, who filled it in with lime and made aerial photographs. Only then was the serpent figure discernible. A test trench excavated across the depression revealed it to be about 10 inches deep with soil mounded up on either side. With the fertile topsoil removed, buffalo grass was the only prairie vegetation that would grow in the depression.

Who created the mysterious figure is not known, but its position relative to nearby villages of the Great Bend culture, dating from A.D. 1400 to 1700, make this connection likely. From 1940 to 1971, five Smithsonian expeditions to the area directed by Waldo Wedel excavated Great Bend villages and three circular earthworks called "council circles." Wedel determined that these circles lined up in the path of the winter solstice sunrise.

Now, Mallam has found that the jaws of the previously indistinguishable serpent were open at an angle to align with the two outlying council circles, the most distant one two-and-one-half miles away and clearly visible from the ridge on which the serpent figure is located. Mallam speculates that the serpent depression may have been the site of an ancient ceremony of the Great Bend culture marking the change in seasons.

The people of the Great Bend Culture were hunters of bison, but also grew corn, squash and beans—and would have used solstice markers to calculate their growing seasons.

Ancient dentistry in Illinois

Drilled abscessed tooth identified in an 800-year-old skeleton

Evidence for dentistry is rare among prehistoric peoples in North America, but a skeleton from the Schild Cemetery site in west-central Illinois demonstrates ancient drilling to relieve an abscessed tooth. The skeleton is that of a male, 35 to 40 years old, dating to the Mississippian culture about A.D. 1100.

A small circular hole about 1/16-inch in diameter was found on a lower left canine of the skeleton by physical anthropologists Della Collins Cook of Indiana University and Bob Pickering of the Field Museum. When a rubber impression was made of the hole, two shallow striations could be seen—drill marks that probably were made by flint tools similar to those used by the Mississippian peoples to engrave shell or drill beads. The drill hole is associated with a large abscess and could have served to lessen the pain.

Where two cultures meet

A northern outpost of Spanish colonialism is found off Georgia coast

Archeologists David Hurst Thomas and Clark Spencer Larsen of the American Museum of Natural History spent three years surveying St. Catherines Island, about 25 miles south of Savannah, seeking to delineate the area where Spanish artifacts were concentrated. With the use of a magnetometer, which meas-

Earl Ford McNaughton

ures distortions in the earth's magnetic field caused by the presence of iron in the soil, the scholars located what proved to be ruins of a Spanish church, residence and a well. More structures are expected to be found in the ongoing excavations.

One of the northernmost outposts of Spain's far-flung Florida colony, the mission was run by only a few priests and soldiers, and the island's population was primarily Guale Indians. The enclave was abandoned in 1680 as the British expanded south from their colonies.

Although the 100 individuals excavated so far in the mission's cemetery were all Guale, the interments were strictly Christian in character. Efforts by the mission's priests to convert the native inhabitants apparently were effective. Religious medallions accompanied some burials, and Thomas thinks that the most important individuals in Guale society were placed near the church's altar.

The church was built of mud and stick construction called wattle-and-daub, with one wall of wood planking. Thousands of glass trade beads for rosaries, as well as crucifixes and icons, identify the structure as a church. Refuse in the mission residence is primarily domestic—imported Spanish olive jars and pottery.

Year-round excavations are continuing under sponsorship of the St. Catherines Island Foundation, which is establishing a center for the study and exhibition of the excavated materials. After studies are completed, the remains of the Guale Indians will be reburied.



Archeologist Charles Faulkner examines ancient drawings in clay from a Tennessee cave.

Photo: National Geographic Society

Still-moist cave drawings in clay

Unique prehistoric art discovered in a cavern in eastern Tennessee

In 1979, a cave explorer in eastern Tennessee stumbled across a unique find—still-moist drawings made hundreds of years ago on the clay walls of a cave. He kept his secret for two years, then told a National Park Service archaeologist, who in turn contacted Charles Faulkner at the University of Tennessee.

Funded by the National Geographic Society, Faulkner, professional cave photographer Bill Deane and a team of researchers spent much of 1982 recording the art. The cave was mapped, the entire passage of drawings was photographed, and an archaeological study of the cave's floor was done. No artifacts or evidence of occupation were found—only the remains of hearths and torches. There was no evidence of mining in the cave either, leading Faulkner to believe that the cave was used solely for rituals.

Many of the drawings are of well-known motifs found on Mississippian pottery, shell ornaments and copper plates, such as the weeping eye, cross enclosed by a circle, and sun symbols. Six radiocarbon dates taken from charcoal in the cave's floor, ranging from the 12th to the 17th centuries, confirm the Mississippian dating.

The cave is extremely wet with difficult access, explaining why the drawings remained so well preserved. Located in a passage 300 feet long, the drawings fall into

four categories: abstract designs, Mississippian symbols, animal and human figures, including a dancing warrior in special dress. Many of the drawings were superimposed over others, and some appeared to be deliberately mutilated, suggesting ritual activity.

Very little is known about the use of deep caves by Mississippian peoples, emphasizing the importance of this site. Since vandals broke into the cave in November and dug into the floor, a stronger gate has been erected at the cave entrance.



A bird figure, possibly a great horned owl, from the Tennessee cave.

Photo: National Geographic Society



Florida's WET SITES

Where the Fragile Past Survives

By George F. MacDonald
and Barbara A. Purdy

Florida has no volcanoes which could have spewed ashes or lava and frozen an ancient community in time, like a Pompeii. Neither does the state have a topography favoring cataclysmic events that could bury and preserve the contents of a village, like the mudslide that entombed the now-famous site of Ozette and its remarkable array of delicate artifacts on the outer coast of Washington state's Olympic Peninsula 400 years ago. It is estimated that as much as 90 per cent of the cultural items that once existed in the typical prehistoric site in North America consisted of perishable materials, and indeed, the high humidity and acid soils of Florida tend to make anything manufactured from such materials as wood or fiber more

(Continued on page 6)



Artist Gordon Miller re-creates a scene of almost 2,000 years ago near Lake Okeechobee, where wood sculpted creatures up to five feet tall stood as spiritual guardians of the dead on a burial platform erected in a pond.



readily vulnerable to the ravages of time there than in many other places on the continent.

At the same time, Florida has been liberally endowed with an excellent agent of preservation—water. As the continental glaciers of the Ice Age melted, sea levels gradually rose, and so, too, did the water table of this low-lying peninsula, whose shallow limestone bedrock and deposits of “hardpan” soils held much of the water in place. Before they were drained to grow sugar cane and vegetables, for example, the “Rivers of Grass” south of Kissimmee were saw-grass marshes through which fresh water moved slowly to the salt-water glades to the south and west. The Everglades itself was inundated between 8,000 and 6,000 years ago, a period which also marked the onset of widespread peat and organic soil development in Florida as the climate became warmer and wetter.

In water-saturated places throughout the state—and not just in rare, isolated situations like the one at Ozette—artifacts made from organic materials have been recovered by the hundreds. Wooden objects abound, originating in greatest numbers from about 6,500 years ago onward.

They include the largest collection of prehistoric watercraft (115) in the world, as well as: totem poles, carvings of animals and birds, human figurines, house and platform pilings, ceremonial masks, cups and bowls, mortars and pestles, ladders, spear and arrow shafts, spear throwers, bows, earspools, painted tablets, net float pegs, carved tool handles,

About the authors:

George F. MacDonald, acting director of the National Museum of Man in Ottawa, Canada, has excavated wet sites both in Florida and on the Northwest Coast. Barbara A. Purdy, professor of anthropology at the University of Florida and curator in archeology at the Florida State Museum, has spearheaded the wet site management program in her state.

Closely resembling ancient Egyptian or Babylonian art, this human-like figure in the guise of a feline was dug from the muck at Key Marco almost a century ago. Barely six inches tall, the figurine is exhibited at the Smithsonian's National Museum of Natural History in Washington.

Photo courtesy Marion Spjut Gilliland and University of Florida Press

stools, fire starters, toy catamaran canoes and canoe paddles.

Such a wealth of wooden artifacts provide unusual opportunities to interpret the ways that ancient groups of people lived—people otherwise known mainly from the limited information available from the pottery and stone tools they left behind. Except for a few controlled excavations, however, most of the wooden objects in Florida have come to light during periods of drought, exposed by a lowered water table, or through dredging and drainage operations. Despite the fact that the first wooden objects began to turn up almost a century ago, stimulating worldwide excitement when perishable materials filling 11 barrels and 59 crates were dug from the muck of Key Marco on Florida's southern Gulf coast, only recently has the archeological potential of so-called "wet sites" in Florida begun to be investigated systematically.

Our studies show that Key Marco was only the tip of an iceberg in revealing the vitality and originality of human adaptations that occurred in Florida. Groups once viewed as poverty-stricken because archeologists had mostly the durable parts of their culture to interpret how they lived are now seen as creative and relatively complex societies, in some cases thriving in places thought to be uninhabitable.

How individual wet sites came to be cannot always be determined with certainty, but generally, they should not be confused with cultural deposits that once existed on dry land and later were covered by rising water. The archeological materials of wet sites were deposited directly into aquatic environments that were oxygen-free, a condition that kept the perishable items from being attacked by destructive organisms. Often, up to 100 per cent of the perishable items ending up in a wet site are preserved in unusually good condition. Furthermore, complete artifacts and biological specimens—rarely recovered undamaged from land sites, even if they later became drowned—remain intact. In most cases, wet sites resulted from the activities of people whose adaptations were at least partly oriented to aquatic environments.

Such was the case at Republic Groves near Zolfo Springs, for example, where in 1968 dragline operators draining a swamp to expand a citrus orchard came upon a cemetery containing abundant organic remains up to 6,500 years old. The spot once was a pool fed by now-dormant springs. Buried in the muck along with such items as tapered wooden stakes, incised deer antler pendants and shark's teeth were stone spearheads similar to ones found on higher ground in a nearby settlement. A local group of

amateurs dug only 400 square feet of the swampy area, and it is estimated that the skeletons of several hundred humans—perhaps as many as 1,000—still lie preserved in undisturbed parts of the site.

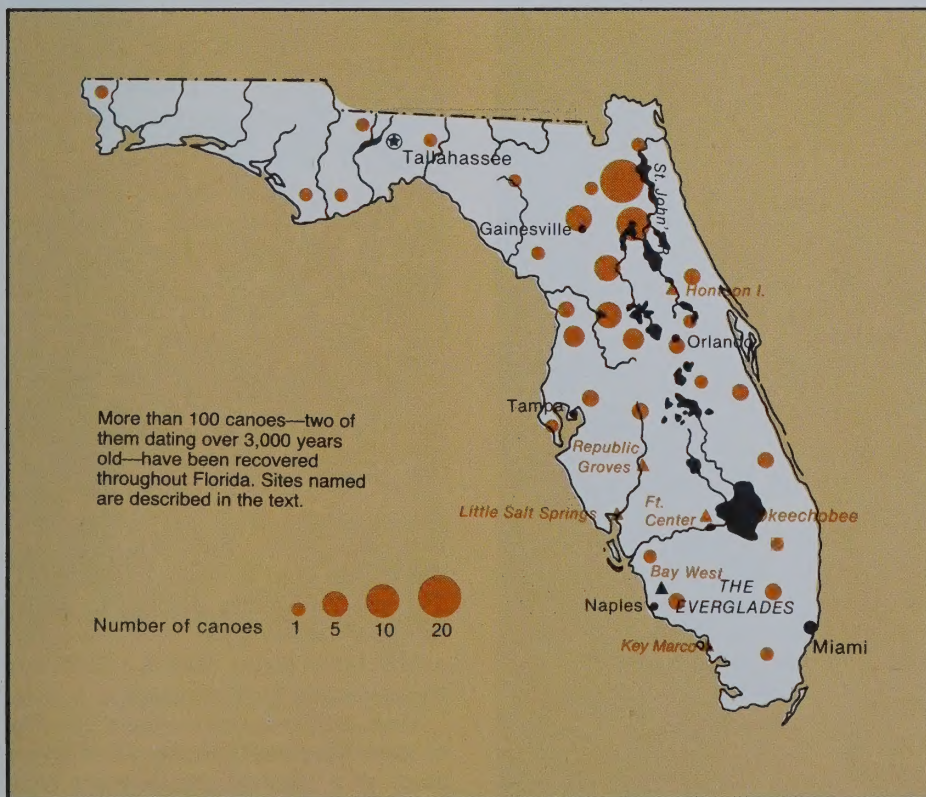
Cemeteries as old as the one at Republic Groves are rare in Florida. Just as Republic Groves supports a theory that the place to look for them is in largely-ignored sloughs—or even in lakes and ponds—so do sites near Naples (Bay West Nursery) and Port Charlotte (Little Salt Springs), both radiocarbon-dated to about the same time period as Republic Groves.

Discovered in 1980 when a cypress pond was being "demucked" to create a small lake for irrigation, Bay West yielded a total of 500 pieces of preserved wood. They included log-like pieces of cypress, sized and shaped by burning and scraping, that may have supported a burial platform. Among 40 pieces identified as implements were a ladle, tool handles and fire starters. The artifacts were recovered by volunteers and members of the Southwest Florida Archeological Society mostly from spoil heaps as the dredging machine tore through the pond, lifting out peat and muck.

Investigated professionally, the story of Little Salt Springs is better known. After initial use of the site by Paleo Indians, it was re-occupied between 5,200 and 6,800 years ago by people who settled on the higher elevations near this sinkhole, when it was ponded to ground level, and interred their dead in the moist, soft peat of an adjacent slough. Preservation was so excellent that archeologist Carl Clausen and his team of investigators could write, in a 1979 *Science* report: "The bodies were buried . . . either on biers of green leafy limbs of wax myrtle or with leafy limbs placed between the arms and torso. Portions of the body were ceremonially wrapped with grass."

At the same time, the fragile materials found in such early sites were mostly utilitarian. The works of art they contained pale in comparison with the masks, figurines, carved wooden birds and animals, and other ceremonial items preserved in later sites. Fort Center, located inland near Lake Okeechobee, and Key Marco, occupied by people oriented to a coastal environment, are notable examples.

Developing in wet savannahs of the Okeechobee Basin once thought to be largely uninhabited, the lifestyle re-





Above: Indians move their crops by canoe to a granary in this scene recorded in Florida by the French explorer LeMoyne in 1564. The state's waterways were the "highways" of ancient times as well.

Right: A prehistoric canoe, one of 19 exposed by drought in 1977 in the central Florida highlands, is retrieved from a lake 25 miles east of Gainesville.



vealed at Fort Center was based on a specialized adaptation that made the environment suitable for growing crops. William H. Sears, professor emeritus of anthropology at Florida Atlantic University, directed a long-term project at this mile-long, village-earthwork site along Fisheating Creek. The following scenario of Fort Center's development is based on Sears's published work:

Sometime between 1000 B.C. and 500 B.C., people possessing a knowledge of maize horticulture built linear earthworks, rising above the level of frequent floodwaters, to create areas suitable for habitation and farming. Later, they also erected circular mounds, surrounded by ditches dug below the "hardpan" soil layer, to provide drained fields. Similar raised agricultural plots appear prehistorically in northern South America, and Sears suggests that this

farming technique may have originated there.

A century or two after the birth of Christ, two of the mounds became the focus of elaborate ritual. A low earth wall enclosed the mounds, where deceased individuals were prepared for interment, and also an artificial pond containing a wooden platform which served as a bier for as many as 300 bundled burials. Birds and animals carved in 10-foot-long pine logs supporting the platform, as well as in shorter pieces of wood that decorated its perimeter, included the eagle, turkey, otter, owl, bobcat, duck and long-legged water birds—30 totemic symbols in all.

The pond was the portion of Fort Center which became a wet site when, after centuries of use, the platform burned and collapsed into the water. In the muddy bottom of the pool, the carvings,

other artifacts and human remains were preserved. Since the pond had been scooped out expressly for the purpose of erecting a charnel platform, water apparently provided the culturally correct environment for the dead according to the beliefs of the people living at Fort Center.

In any event, they became strongly dependent on external sources for the material goods they needed to support the increasingly complex social system that evolved. In their excavated middens were tools made of stone from north-central Florida, and limestone, shark's teeth and marine shells from both the Atlantic and Gulf coasts. According to Sears, one of the ceremonial center mounds contained pits in which mussel shells were burned to produce lime for the treatment of hard, dry corn. The technique of soaking stored corn in a lime solution to make it palatable, Sears points out, appeared centuries earlier in Mesoamerica than it did at Fort Center.

Sears's speculations about cultural influences in southern Florida from distant shores are not supported by direct evidence of contact. However, intriguing wooden artifacts from Key Marco provide insights into the sea-faring capabilities of early coastal dwellers in southwest Florida. Among the hundreds of wooden objects recovered from a settlement which existed there for many centuries, up to about A.D. 1400-1500, were a toy catamaran canoe and parts of full-sized rigging, including a possible bark-mat sail.

When the Smithsonian's Frank Hamilton Cushing uncovered Key Marco's myriad of organic artifacts in the 1890s, working with archeologists from the University of Pennsylvania, he dubbed the site: "The Court of the Pile Dwellers." It was in the muck of a one-time water-filled channel there that Cushing found wooden masks, figurines and painted tablets confirming that Key Marco was a ceremonial center of great importance, as well as a vast number of objects used in daily living. The latter included shells made into chisels, hammers and adzes, barracuda jaws and shark teeth used as wood carving tools, and wooden handles attached to implements of various kinds. A whole specimen of bottle gourd, used as a float, was found encased in fiber netting.

How such a varied and rich quantity of materials came to be deposited in one place is a mystery that has not been explained. The site cannot be re-evalua-

ted—in and around it today are homes and resort facilities. The story of Key Marco (now called Marco Island) has an even more tragic footnote: Little was done to preserve the fragile objects—most of them have now fallen to pieces or are in an advanced state of decomposition. Even the few items on display at the Smithsonian and the University of Pennsylvania museums are in a poor state of preservation.

In order to improve our capabilities of managing Florida's wet site resources, the University of Florida embarked on a program in 1980 to determine how extensive they are, predict the most promising areas for research, compile everything known about these unique sources of knowledge in a computerized databank, refine the specialized techniques needed for controlled excavations in water-saturated conditions, and cope with the problems of preserving wood objects and plant materials.

The master file of sites is not confined to places of ancient activity, but also includes isolated finds of wooden artifacts over the years—such objects as totem poles, figurines, bowls and canoes. In fact, when a drought caused the water table to drop in 1977, it was the exposure of 19 canoes—mostly in the central highlands of Florida—that strengthened our resolve to investigate wet site potentials statewide. Emphasizing years of inattention to the state's maritime heritage was the fact that we had neither the time, money, personnel nor facilities to preserve the canoes properly.

The total of 115 canoes now recorded—two of them dating to more than 3,000 years ago—range up to 46 feet long. Even the 20-footers, however, are easily big enough to transport several people and all manner of merchandise. Clearly, they demonstrate the importance of Florida's waterways to aboriginal populations, providing as they did "highways" for communication and trade.

Beyond factors of utility and safety in environments studded with swamps, dense vegetation, dangerous animals and noxious insects, however, canoes

Warped and shrunken—and its jaw broken off—this wooden mask from Key Marco is even more degraded today than when the photo was made six years ago.

Photo: Kay Purington





Photographed shortly after it was recovered from the St. John's River in 1955, the six-foot-tall owl (above) is the largest wooden totem known in Florida. Nearby, carvings of an otter clutching a fish (below) and a pelican were later found. Replicas of all three can be seen at Hontoon Island State Park.

Photo: Florida Anthropologist, September, 1955



Photo: Florida Bureau of Archives, History and Records Management, Tallahassee

can also be studied as adaptive mechanisms, considering that water travel provided a high energy source for people who otherwise were low energy users. Compared to an overland trip, our studies show, four people transporting goods in a canoe for 50 miles would save 25,000 calories—enough to sustain a small band of people for an entire day.

In effect, water transportation functioned as a means to build "capital," with the time and energy saved being applied in increasing amounts to activities not related directly to subsistence: monument building, artwork, ceremony, warfare. Seen in this light, the efficiency of the canoe undoubtedly played a role in making possible the rise of complex societies in Florida's distant past—perhaps elsewhere in the U.S. as well.

In some cases, it may even be possible to draw parallels between perishable objects found in Florida's wetlands and those which have decayed on sites in other regions. One is immediately struck, for example, by the similarities between totem poles recovered in Florida and the monumental carvings for which the Northwest is famed. Surprisingly, a prehistoric example of a totem pole has never been found preserved in a Pacific coast site. However, far back in time, houseposts in particular were certainly carved there with crests, a practice that was probably common in many other areas of prehistoric America. Both for the Pacific Northwest and Florida, historic records indicate that structural houseposts were recycled into grave monuments on the death of a chief.

(Interesting relationships between the two areas are also to be found in the quality of their woodcarving; technological features common to both involve the shell-bitted adze. In Florida, adze blades were made from the heavy walls of conch shells. On the Pacific coast, they were made from the extremely hard shell of California blue mussels. Both species of marine shell provided extremely sharp and durable cutting edges that were far superior to the bits achievable in any variety of stone except jade or jadeite.)

The largest totem pole discovered in Florida bears the six-foot-tall sculptured image of a great horned owl. At least 500 years old, the carving and its perch were fashioned in the heartwood of a southern yellow pine log more than 12 feet long. So heavy was the water-logged timber that chains and power equip-



Bulging eyes and a crouching mouse decorate this elaborately carved wooden adze handle from Key Marco. The tool's cutting blade was a sawfish tooth or piece of shell, held firmly in a deer antler socket which fit over the handle's tongue.

Photo: Kay Purington

ment were necessary to lift it from the St. John's River near DeLand, where dredgers freed it from the silty bottom in 1955. Originally, the monument had stood upright near the water's edge, probably a clan symbol for people known to have lived along the river on a shell ridge. Since the discovery of the owl, now housed at the Florida State Museum in Gainesville, large carvings of a pelican and an otter have also been found on the opposite side of the river in the vicinity of Hontoon Island State Park.

In December, 1980, as a part of our assessment of wet sites existing in Florida, we received permission from the Bureau of Historic Sites and Properties to excavate a 10-foot square area below the water table at Hontoon Island. Finding totem poles nearby was intriguing, but what attracted us mostly to the island was a former lagoon, now largely silted up, which had been formed by the blockage of a one-time meander channel of the St. John's River. We knew that this lagoon had been adjacent to an ancient village, and experience told us that it would have been the favored place for villagers to dispose of food remains, tools and utensils.

As we excavated the 10-foot square, pumps worked continuously to keep the pit drained of water from seepage and from the hoses used to "dig" the deposit by sluicing. The unit was excavated to a depth of almost five feet, and from its matrix of peat and shell, we extracted 5,777 bone fragments, 3,624 pieces of wood and 3,265 pottery sherds. Plant materials were recovered as well, including intact specimens of fungi—used historically by Indians for tinder and paints—that have never before been reported from an archeological site in the Western Hemisphere.

In all, 48 species of animals and 25 species of plants were identified from our single 10-foot excavation unit. The excellent preservation of organic materials at Hontoon will permit, for the first time in Florida, an assessment of the relative importance of plant and animal use by prehistoric groups, which occupied Hontoon Island from A.D. 850 to 1750.

Moreover, the time period represented at Hontoon spans the Spanish incursions into Florida, and careful study of the deposit reveals a disruption in village life coinciding with events of this time—about A.D. 1540. Shellfish



Among the hundreds of recovered wooden objects used in daily living at Key Marco were these mortars and pestles, presently housed at the Florida State Museum.

Photo: Kay Purington

remains and evidences of distant trade, abundant in our excavated square up to this disruption, virtually disappear. Terrestrial animals such as gopher, tortoise and deer become the dominant resource utilized. Worked wood after A.D. 1540 appears to have been cut with a metal ax.

Thus, Hontoon Island appears not only to have the potential for duplicating the spectacular finds at Key Marco and Washington state's Ozette, but it also contains remains of the only historic period Indian settlement known in eastern Florida other than Spanish-influenced mission sites. We hope to expand the investigations at Hontoon soon.

In the meantime, we believe the pub-

lic is anxious to proceed with this kind of archeology, revealing as it does samples of artwork, information about primitive technologies and other evidences of daily living that rarely survive in the archeological record. The preserved maritime heritage of Florida is fully as old, elaborate and plentiful as that of the famous Swiss Lake Dwellers, whose houses stood on pilings in lakes scoured by glacial ice.

However, wet sites in Florida are an endangered, invisible heritage (see sidebar). They are unwittingly being destroyed by people who would never dream of harming a Greek statue, and they must be found before the dragline

either crushes their fragile contents or causes them to become dry, structureless masses. Archeologists who up to now have largely overlooked such sites should include them in site surveys, funds should be allocated to investigate them thoroughly, and the public should learn of them. ☹

For further reading:

Gilliland, Marion Spjut, *The Material Culture of Key Marco*, University of Florida, 1975

Sears, William H., *Fort Center: An Archeological Site in the Lake Okeechobee Basin*, University of Florida, 1982.

The invisible danger to wet sites

Wooden artifacts which have lain for centuries in the oxygen-free wetness of a peat bog, even though they may not degrade, lose some of their internal structure. The most effective chemical known to preserve them—wax-like polyethylene glycol—penetrates the wood, replacing the water that has been holding the artifact in shape. Untreated, water-logged objects shrink and warp, leaving them valueless for study or exhibit. Exposed to the air, wooden artifacts also become vulnerable to destructive organisms.

These same harmful effects occur, even if wooden artifacts remain entombed in protective peat or muck, when water is drained from the deposit. Drainage of wetland areas has been extensive in Florida, dating in some places to the late 1800s. In south Florida, for example, the water table has been artificially lowered more than six feet in the last 40 years. One can only speculate on the countless archeological sites containing wooden artifacts and other organic re-



Seepage in a wet site calls for pumping and specialized techniques to excavate scientifically, as this test square at Hontoon Island illustrates. But if water were drained from the surrounding silted-up former lagoon—to grow vegetables, for example—priceless ancient remains of water-logged wood and other perishable materials would soon decay after they dried out.

Photo: Barbara A. Purdy

mains that have been destroyed throughout the state as the result of ambitious drainage programs for housing developments, farming and peat production.

Most of the peat produced in Florida today is sold to nurseries for humus and fertilizer. Studies are currently under way, however, to determine the feasibility of mining the state's three-million acres of peat—equivalent to nearly 14 billion barrels of oil—as a domestic substitute for imported energy.

In England, archeologist John Coles, leader of the Somerset Levels Project, notes that peat cutting has lowered the water table and started cycles of decay

up to several miles away from the drainage area that can eliminate the remains of wooden structures 5,000 years old in as little as two to five years.

One of the lessons to be learned is that projects disastrously affecting water-saturated sites do not have to take place in the immediate vicinity of these cultural deposits. Often, we hear, "Why excavate sites if they are in protected areas?"—a federal wildlife reserve or a state or national park. A wet site protected from vandalism is not always guarded from the wrath of Mother Nature after human intervention has occurred.

—Barbara A. Purdy

Washington Report

News and views affecting archeology from the nation's capital: by Ellen Herscher

Finally...victory for UNESCO Convention legislation: After 10 years of struggle by its supporters, a bill implementing U. S. participation in the UNESCO Convention on Cultural Property passed virtually unnoticed through the lame duck session of Congress in December. The bill provides new legal means to halt the import of stolen artifacts, helping to combat archeological site looting which supplies the antiquities market. A similar step by France is expected shortly...and heavy pressure to act on the UNESCO Convention will now be felt by England, Switzerland and other art importing countries.

More good news for preservationists: One of the few appropriations bills to pass the 97th Congress in December was for the Department of the Interior and related agencies. Reductions for historic preservation sought by the administration were rejected across the board, with spending levels comparable to FY '82 approved. Examples: \$26 million for the National Historic Preservation Fund (with \$21.5 million going to State Historic Preservation Officers)...\$1.5 million to the Advisory Council on Historic Preservation...\$10.8 million for the Institute for Museum Services (the agency the administration wanted to eliminate entirely)...and \$130 million for the National Endowment for the Humanities. Undaunted by the Congressional action, the administration in January submitted a budget for FY '84 again "zero-ing out" the State Historic Preservation Officers and setting the Advisory Council's budget at \$1 million.

'Gas Tax Bill' could have a negative effect: State Historic Preservation Officers are fearful that legislation passed by the 97th Congress to boost highway taxes and rebuild the nation's highways could put pressure on their efforts to protect historic and archeological sites. In some states, a five-fold increase in highway construction is expected over the next year, with many projects put on a "fast track" to generate jobs in a hurry. Though much of the money will go into repairs of existing facilities, new construction will occur as well. SHPOs are concerned about their ability to monitor the work, especially with their reduced staffs resulting from recent historic preservation budget cuts.

1983 Conservation Corps Act: In late January, Patrick Moynihan (D-New York) introduced in the Senate S. 27, a bill "to provide for the conservation, rehabilitation and improvement of natural and cultural resources located on public or Indian lands". The bill would authorize some \$250 million per year through 1989 to support an "American Conservation Corps", whose purpose is to put unemployed young people to work on projects that would include "historical and cultural sites preservation and maintenance". Preservation officials in Washington say they have not yet had time to assess the bill's possible effects on archeology.

Shipwreck legislation re-introduced: Congressman Charles Bennett (D-Florida) has re-introduced legislation to establish federal ownership of historic shipwrecks on the continental shelf. The same legislation died in the 97th Congress after opposition by the administration, which argued in part that it was inconsistent with existing U. S. preservation statutes. An alternative bill addressing the administration's concerns was expected to be introduced in the Senate soon by John Tower (D-Texas).

'OSMPMOA' stalled? A controversial Programmatic Memorandum of Agreement developed by the Office of Surface Mining (OSM) in the Department of the Interior and the Advisory Council on Historic Preservation—referred to as 'OSMPMOA' by its proponents—appears stalled after drawing criticism from archeologists at a public meeting held in Washington. OSMPMOA would establish new ground rules for archeological surveys and data recovery in advance of surface coal mining on federal lands. Most of the controversy stems from OSMPMOA's replacement of the current field survey standard—which calls for 100 per cent inspection of the ground surface to find archeological sites—by the use of predictions about site locations to guide surveys.

Follow-up on revised coal mining regulations: A final Environmental Impact Statement on proposed revisions of permanent regulations covering surface mining programs operated by the states was issued by the Office of Surface Mining in January. The revised regulations, like the draft heavily criticized by archeologists and environmentalists late last summer (see *Early Man*, Autumn, 1982), protects only publicly-owned sites that have been listed in the National Register of Historic Places, leaving the bulk of archeological sites without protection. OSM was expected to adopt the revised regulations formally as *Early Man* went to press.

Cahokia joins the elite: National Park Service officials in Washington received word from Paris in December that the Cahokia Mounds State Historic Site near St. Louis had been officially named to the United Nations World Heritage List. Only two other prehistoric archeological sites in North America are presently so honored: Mesa Verde National Park in Colorado and the Viking settlement of L'Anse aux Meadows in Newfoundland.



I am a middle-aged worker in a commune, where in 1961 the county cultural bureau came to set up an exhibition with stone arrowheads, net weights, pottery and other artifacts from a Han site. I could visualize how the ancient people actively engaged in fishing and hunting, and since then, I have reported to the cultural bureau many artifacts I found while working in road construction and in my farming. I looked for other people in the commune interested in archeology and we formed an amateur group. In 1973, I took part in more than 10 excavation projects organized by the cultural bureau.

The People's Archeology

By Wing Sam Chow

These words of Pan Hongzhong, a peasant living in southern China, must strike sympathetic chords in the heads of amateur and professional archeologists the world over. While Pan's avid interest in archeology—especially his lead in organizing a local group able to participate in government-sponsored excavations—cannot be said to be shared by all of China's vast population, his words symbolize how China's archeological past is being discovered by her workers and peasants. Many discoveries of historic objects or archeological sites—if not most of them—are made by workers in the process of doing something other than archeology. These accidental discoveries

include not only pieces of pottery or arrowheads as Pan found, but some of the most spectacular ruins in the world.

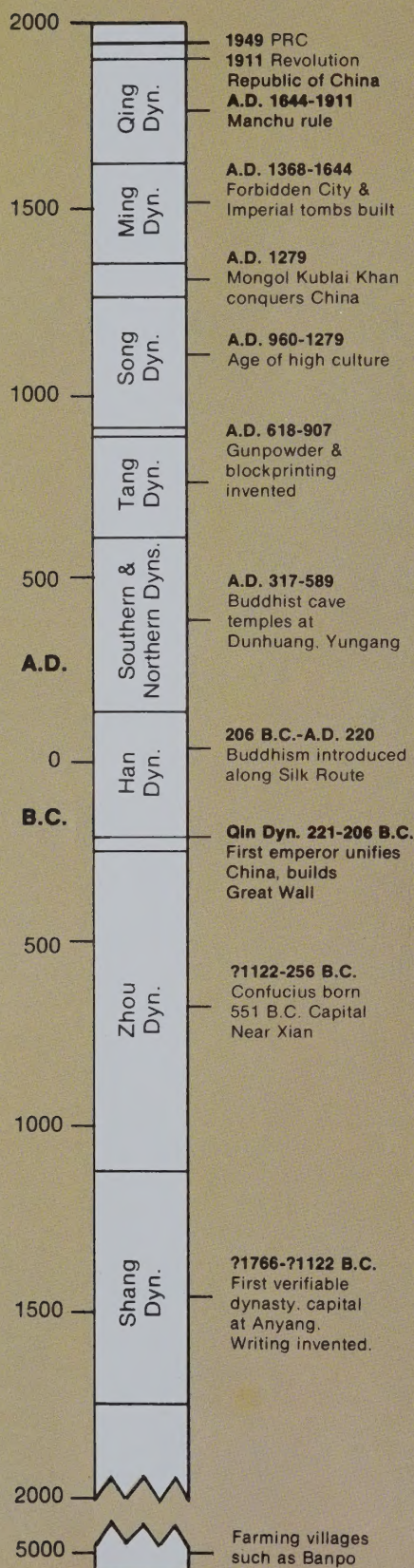
The tomb of Liu Sheng in Hebei Province in northern China, sealed for 2,000 years, was discovered in 1968 by soldiers of the People's Liberation Army. Liu Sheng's death suit, made of more than 2,000 pieces of jade wired together with gold, was one of the highlights of the overwhelmingly popular exhibit, "Archeological Finds of the People's Republic," which toured major U.S. cities in 1975. The underground vault of the east wing of the mausoleum of Qin Shi Huangdi, who conquered rival states to become the first emperor of China, was discovered by peasants of the West Poplar Production Brigade of the Yanzhai People's Commune while digging a well. The vault is now a showcase of an ongoing archeological project which annually draws several million Chinese visitors, as well as thousands of

foreigners. Under a huge protective roof, archeologists work to restore what are estimated to be 7,500 terra cotta warriors, each life-sized with individually modelled heads representative of the ethnic groups under the emperor's command 2,000 years ago.

Hundreds if not thousands of archeological sites were uncovered in the 1950s when mountains of earth were moved to build dams, roads, factories, railways and other modern improvements. The sheer number of sites, and the richness of their contents, came as a challenge to China's archeologists and politicians. After a half-century of pillage, looting and secreting away of Chinese antiquities into museums and private collections in the western world, much still remained to find, to teach, and to foster national pride. At the same time, much of this richness was threatened by China's desperately needed programs of modernization.

Inside the huge exhibit hall built over the east wing of Emperor Qin Shi Huangdi's mausoleum, modern Chinese visitors look down at a life-size terra cotta army made more than 2,000 years ago.

Significant events in Chinese history



In the 1950s and early 1960s, archeology in China was encouraged by the State. Archeologists labored at early farming sites like the village of Banpo in the district of Xian, excavated between 1954 and 1957 in an effort to understand the beginnings of China's agricultural economy. Part of the 6,000-year-old site was reconstructed and enclosed as the Banpo Site Museum. The re-excavation of Zhoukoudien (Choukoutien) in 1959, and of other early Stone Age sites in central and southern China, altered and deepened our understanding of the antiquity and distribution of *Homo erectus* and his successors in eastern Asia. An exhibition center was built at Zhoukoudien which receives at least 100,000 visitors annually.

Also in the early 1960s, a bureaucratic structure was created to protect and administer historic properties. Offices concerned with such matters are usually called "Cultural Relics Bureaus." They exist at many levels, sometimes as local as a single commune, but more usually parts of city, county or provincial governments. Cultural offices at the provincial (U.S. state) level are primarily responsible to their own governments. The State (U.S. federal) Bureau for the Care of Historical Relics remains in an advisory role—not a directive one—relative to the provincial bureaus. This means that many decisions are made at very local levels of administration, and throughout the country, cultural offices vary tremendously in their range of activity, their ability to influence other government organizations, and the quality and education of their personnel.

Local, provincial and national cultural relics bureaus have operated since 1961 within the legal framework of the "Provisional Regulations on Protection and Administration of Cultural Relics." These regulations stress the responsibility of local people's committees for the protection and administration of their areas' historic properties. They also provide for the integration of protective measures—including archeological survey, salvage and preservation—with urban planning and construction, and for the regulation of archeological excavations and historic building restorations.

This was the legal and administrative situation in 1966 at the beginning of the Cultural Revolution, when scholars whose fields of study grew from western science and philosophy were ousted from participation in the Revolution. Unfortunately, among those rejected

were many of China's archeologists. The publication of journals like *Kaogu* (Archeology) and *Wen Wu* (Cultural Relics) was suspended from the mid-1960s until the early 1970s. The specific impacts of the Cultural Revolution on historic sites and on those responsible for them were generally determined by local politics, which were often highly factionalized. The legal and bureaucratic structure remained intact, but regulations were reinterpreted, ignored or used by local Red Guard units to suit their own purposes.

In Shaanxi Province, senior members of the Shaanxi Bureau of Antiques Administration were disgraced as reactionaries interested in the tombs of emperors and not in the lives of poor peasants. While they were not allowed to pursue their work, others, apparently in political favor, were able to continue. It is said that more than 160,000 artifacts were discovered in Shaanxi Province alone in the early years of the Cultural Revolution.

During the same period in Hangzhou, Zhejiang Province, high school students from Hangzhou attempting to destroy the Ling Yin temple were stopped by students from the University of Hangzhou, and the fate of the temple was debated for days. Finally, a telephone call from then-Premier Zhou Enlai to the municipal government settled the debate and prevented the temple's destruction. Zhou Enlai's influence was also critical in the struggle to protect the "Forest of Stelae" at Xian, a 700-year-old collection of more than 2,000 columns of stone art which form a priceless record of history and philosophy as well as of the different schools of writing.

Today, national and local political sentiment again stresses the importance of protecting China's historic resources. Newspapers carry slogans as headlines, such as "To Protect Historic Sites Is to Cultivate National Dignity and Confidence, and to Augment Socialist Morality." Chinese today have a legal duty, and even more overriding in daily life, a political duty to protect historic sites, to be aware of the potential for discovering historic objects, and to report them to the appropriate cultural bureaus when they are found.

In the last decade, the revitalized archeological journals *Wen Mu* and *Kaogu* have published many examples of for-

Mountains of earth were moved to build dams, roads, factories . . . uncovering hundreds of archeological sites



tuitous discoveries reported by peasants and workers, and have stressed not only the value of the finds, but also the responsible attitude shown by those cooperating with their local cultural relics bureaus. One of dozens of such reports came from Chengdu, Sichuan Province, in 1976. There, when a group of workers at a construction site discovered a cache of copper coins, they reported the find immediately to the Chengdu Cultural Relics Bureau. The coins, totaling more than 50 pounds, were found to have been issued by Zhang Xianzhong, who led a peasant uprising in the 17th century.

The cooperation and responsibility shown by the Chengdu workers is apparently very common in China today. It reflects a widespread encouragement of historic preservation activities by government at all levels. Reporting discoveries is officially praised as an attack on black market antiquities trafficking, which is seen as an evil drain on China's national heritage.

The effectiveness of the official government stance is dependent not only on its education programs and ideological positions, but also on group pressure at levels as local as commune work groups, and on political rewards distributed by cultural bureaus. The collective organization of work in China serves to inhibit individuals from illegal private collecting or dealing. The work of the cultural relics bureau has been publicized so widely that even most children are aware of the bureaus and their importance.

Late in 1981, the Standing Committee

of the People's Congress of the city of Beijing, one of several Chinese cities whose governments stand on a par with the provinces and autonomous regions of the nation, ratified stringent "Methods for the Protection and Administration of Beijing's Cultural Relics." These provide for the systematic identification and protection of Beijing's historical sites and objects, a welcome change, since the capital city suffered badly from the depredations of the Red Guards during the Cultural Revolution. Dealing in Beijing's antiquities is specifically forbidden, and damaging construction work is forbidden in the vicinity of designated cultural areas.

Beijing in recent years has also urged factory workers to look out for antiques from private collections which have become mixed with metal scraps in junk yards. The factories are told to collect the relics and redirect them to the Beijing Administrative Bureau of Archeological Data and Museums via government purchasing stations. The factory that recovers the material receives some financial reward, and is further encouraged by the annual distribution of citations and awards to individuals and work units successful in recovering antiques.

Items collected are examined by experts, and rated on a scale of significance. In 1981, Beijing factory workers picked up and donated 395 antiques and more than four tons of coins from metal scraps. Among the antiques, 72 were rated as important, including bronze cooking and drinking utensils, and vessels and weapons from the Shang

Dynasty (16th-11th century B.C.) and the Warring States period (ca. 403-221 B.C.).

Yet now that China is once again opening its doors to the outside world, the illicit trade in antiquities has been reactivated. During 1982, the *People's Daily* reported on a black market in antiquities that has developed in Luoyang and Kaifeng. Newspaper items concerning the smuggling of antiquities between the interior and Hong Kong, a major port of exit for stolen goods, are common. In the words of an editorial in the *Beijing Daily* in November, 1981:

"We must punish according to law, without leniency, those black-hearted profiteers who regard our laws lightly and steal, destroy, resell and seek opportunistic ventures with our valuable relics. We must not let our cultural relics be destroyed, lost through our own hands, and be a failed son who is unable to face his seniors and is ashamed in front of his grandsons."

Like most nations, China takes special pains to register and maintain sites that are viewed as having broad significance to the nation. In the late 1950s and early 1960s, both provincial and national governments drew up registers of properties deemed valuable for their historic, scientific and artistic qualities. More than 175 properties were designated "Key National Cultural Relics" by the State Council in 1961, and 62 were added to the list in 1981. The properties are grouped into the categories of Ancient Architecture,



Chinese workers with the Shaanxi Provincial Bureau of Cultural Relics excavate the foundations of a 16-17th century structure, uncovered during restorations of a building (left background) near Xian.

Photo: Bennie C. Keel

Revolutionary Sites and Memorial Buildings, Archeological Sites, Historic Tombs, Stone Caves and Stone Carvings and Inscriptions. The first city-level register was made by the city of Beijing in 1957. A second was made in 1979, and in August of 1982, the newspaper *China Daily* reported that more properties, including nobles' houses, theaters, guild houses, temples and courtyard houses were being added to the register.

The central government supplies funds for the management of many properties designated as Key National Cultural Relics. Maintenance offices have

been set up at most of these sites, and research institutes and museums are associated with some. Most experience heavy visitation by the public, to such an extent that the impacts of human use and traffic on sensitive works of art, architecture and archeological deposits have become the object of serious official concern.

The Anyang Archeological Team of the Institute of Archeology is an example of a national level research station. The Archeological Team is responsible for the Yin Ruins, which cover an area of almost eight square miles. Once the

capital city of the Shang Dynasty, Yin was destroyed in the 11th century B.C. and forgotten for 3,000 years. At the end of the 19th century, the discovery of large numbers of oracle bones inscribed with ancient Chinese script attracted archeologists. Many of these objects, along with excavated bronze vessels, were taken out of China by foreign archeologists and others. Tombs were plundered unmercifully, and the stolen artifacts were sold to foreigners. Yin is now under strict government control, and the Archeological Team is responsible for its continued exploration. Well preserved royal tombs and the graveyards of commoners have been found, together with sites at which bronze casting was done. The tombs, for example that of Fu Hao, excavated in 1976, contained hundreds of jade and bronze objects. Lacking funds for the tomb's restoration, the Team refilled it after excavation and recording were complete.

Large scale restoration efforts have begun at the Yungang caves in Shaanxi Province. Hollowed out of mountain cliffs, 53 caves containing 51,000 sculptures reflect much of the material culture of fifth century northern China. The caves and sculptures commemorate the period when the northern Wei Dynasty first embraced Buddhism, about 1,500 years ago. The sculptures have suffered badly from erosion, looting and the effects of extensive coal mining which fills the air with soot. Axe-marks from lootings over the last century are visible on some of the statues, and incomplete statistics indicate that more than 1,400 statues have been damaged or stolen. A maintenance office established by the State Council now administers the site, where archeologists, architects, geologists and artists are working to repair and restore its artwork. Protective walls enclose the grottoes, and trees have been planted to protect the site from dust.

The author of this overview on the conservation of archeological sites in China, Wing Sam Chow (shown here at the Lingyin Temple in eastern China near Shanghai), was born in Malaysia. In the 1960s he came to Canada to study at the University of Manitoba and became a Canadian citizen. Receiving a PhD in anthropology from Michigan State University, Chow has specialized in the ethnography of China and Southeast Asia and currently teaches at the University of Winnipeg. Chow has been to China many times, and is currently studying the impact of tourism on local communities in that country.



The results of archeological research in China have regularly been applied by the government to illustrate Marxist doctrines to the people. Research projects are aimed at demonstrating how change has occurred in economic and social institutions in a manner consistent with Marxist theory, and to draw attention to past class struggles among peasants and nobles. More

practical applications also seem to be appreciated by archeologists and non-archeologists alike. *Kaogu* and *Wen Mu* have featured articles by the Beijing Jade-Carving Plant's Technical Study Group, the Jiangxi Institute of Timber Industry, the Forestry Institute, and the Purple Mountain Observatory and Planetarium on the applications of archeology to their areas of interest.

Land subsidence is a serious problem for urban and industrial development planning in Shanghai, at the mouth of the Changjiang (Yangtze) River. Controlling subsidence, or acknowledging its influence on planning, requires knowledge of the dynamics of natural landform development along the Changjiang. Archeological studies have revealed early farming settlements about 4,000 years old in the western part of Shanghai, making it possible to correct the estimate of foreign scientists some years ago that the area emerged from the sea about 2,000 years ago.

Some 800 miles upstream, where the Changjiang breaks out of the mountains of Sichuan at the spectacular Three Gorges, flooding presents a major problem for agriculture and industrial development. Here the Chongqing (Chungking) Museum uses archeological research to augment a written record 2,000 years long to calculate the frequency, scale and duration of floods in the past. This provides a basis for predicting when and how floods will occur in the future and for identifying flood-sensitive areas.

Twenty-four cities recently were designated by the State Council as important urban historical and cultural sites. These include centers of early civilizations such as Keifeng and Luoyang, ancient port cities such as Guangzhou and Quanzhou, capital cities of past dynasties, such as Beijing, Nanjing and Xian, and Qufu, birthplace of Confucius. The designations were made in response to recommendations submitted by the State Administrative Bureau of Museums and Archeological Data, the State Capital Construction Commission and the State Administration of Urban Construction.

Future planning and development in the designated cities must pay special attention to their historic and cultural characteristics. In Qufu, for example, the boundaries of 15 key areas to be protected have been determined, based on surveys done in 1977 and 1978. A railway, once planned to cut across the old city, has been rerouted to bypass it. Plans for tourism development have been modified to protect the integrity of the historic areas.

City planners in Beijing have stressed that protection of historic sites extends to their surroundings. Quoted in the *Beijing Review*, Wu Liangyong says:

"What would be the Palace Museum with its yellow glazed tiles, white marble balustrades and red pillars without a wide expanse of blue sky and scudding white clouds? Its beauty will be marred if it is hemmed in by big buildings and tall chimneys belching black smoke."

Beijing's tight standards for historic preservation, adopted in 1981, severely limit new construction in the vicinity of historic places. In Xian, planners express embarrassment over a group of modern apartment buildings built between the main vault of Qin Shi Huangdi's mausoleum and its east wing "ceramic army" some years before the army was found in 1974, and are developing plans to remove them. In Luoyang, concerns about air pollution, as well as a desire to maintain pleasing vistas around the Lougmen caves, has resulted in the redesign of the area's road network to route traffic away from the caves. The Lougmen railway station has been preserved as an historic building, contributing to the pleasant scenery around the caves. Luoyang is also an area where the value of China's diverse vernacular architecture has been recognized by the government—protected status has been given to contemporary cave dwellings at Zhong Tou village in Luoyang.

The idea that the past tells a people where they came from, and that ancient relics are part of what the people are today, is not just a philosophical ideal in modern China, but a guide that inhabitants of this huge segment of the earth are living by. ☸

Background research for this article was provided by Patricia L. Parker, a cultural anthropologist who is currently studying changing legal systems in Micronesia.

A comparison: Archeology in China and the U.S.

If Wing Sam Chow is not looking through rose-colored glasses in assessing archeological awareness and the effectiveness of historic preservation in China, and his portrayal is accurate and realistic, there is much to envy in the way this expansive Asian country recognizes its cultural heritage. At the same time, differences in the ideologies and social systems of China and the U.S. account for much that separates the archeological preservation policies and programs of the two countries.

For example, in China properties cannot be recognized as having historical significance until they are ratified through

a political process by the responsible people's committee. In the U.S., recognition of something as historical is regarded as a professional determination. China asserts state ownership of all archeological sites, where the U.S., with its commitment to private property rights, extends the jurisdiction of government only to sites lying on government land or affected by government-involved projects.

Furthermore, rewards for reporting, protecting or rehabilitating archeological sites in China include unspecified financial awards, citations, other kinds of recognition in the community, and sometimes political advancement. Rewards in

the U.S. come mostly in the form of personal pride, although tax incentives are provided in some cases.

Nevertheless, as both countries have carried out public works projects that threaten prehistoric sites and historic buildings, there are parallels between the two nations in the recognition of a need for procedures to protect and administer such properties. How are these procedures alike? How do they differ? The next issue of *Early Man* will compare archeological preservation in the U.S. and China, illuminating some startling differences between these world powers in the treatment of their cultural heritage.

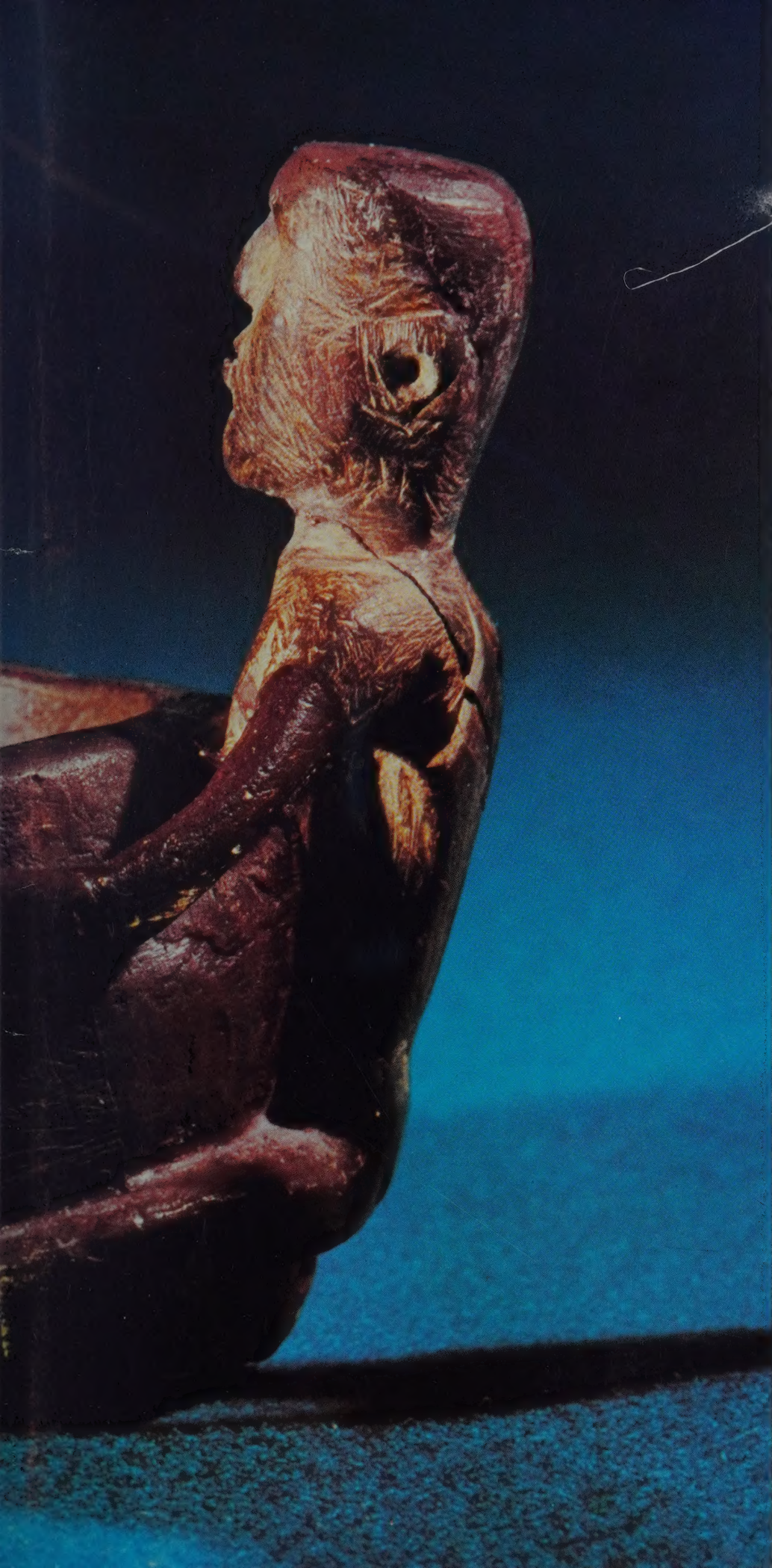
The Mysterious Hohokam— Masters of the Arizona Desert

Where did they come from? What happened to them?
Deciphering the rise and fall of these brilliant engineers and
craftsmen presents archeology with one of its greatest challenges



*Typical of the spectacular achievements of
Hohokam artisans, this vessel carved in
stone was excavated at Snaketown in the
1960s and was used for burning incense.
Examples in other mediums of the skills and
sensitivities of Hohokam craftsmen are
shown on pages 22 and 29.*

Artifact photos courtesy Arizona State
Museum, University of Arizona; Helga Teiwes, Photographer.



By Evan Hadingham

Less than a thousand years ago, an amazing culture flourished in the arid Sonoran Desert of southern Arizona. Underneath modern city buildings and cotton farms in the neighborhood of Phoenix and Tucson lie the remains of settlements and canal networks that once extended far out into the desert. These were the work of a vanished people known to archeologists as the Hohokam, who settled the region of the Salt and Gila river valleys continuously for at least 10 centuries, from A.D. 350 to 1400. This record of successful adaptation to the desert is remarkable in itself. How was it possible for a sophisticated culture to flourish in such difficult surroundings?

The task of explaining the achievements of the Hohokam has challenged scholars of the Southwest for many years. The most celebrated Hohokam accomplishment, their elaborate canal systems, at once distinguished them from other ancient cultures of the region. More than 1,000 miles of canals have been recorded in the Salt valley around Phoenix alone. Substantial buildings of sun-baked mud were also erected, notably the famous Casa Grande monument near present-day Coolidge, which almost certainly served as an astronomical observatory.

In addition to their intellectual and engineering accomplishments, the Hohokam were skilled craftsmen. Delicate shell bracelets—the raw material traded all the way from the California coast—were fashioned in elegant rippled out-

About the author:

*Evan Hadingham is an archeologist and author currently working for the Institute for Conservation Archeology, Peabody Museum, Harvard University. His latest book, *Sky Visions: An Exploration of Ancient Astronomy*, will be published next fall.*



The Hohokam: Far-Ranging Traders

From a ceramic figurine of the earliest times to a turquoise mosaic on shell of the Classic Period, forms of expression among the Hohokam were unusually sophisticated. These examples also attest to the extensive trade relations of the Hohokam—the carved bracelets and other shell ornaments were made of raw material from the Gulf of California . . . turquoise came from Pueblo neighbors to the north . . . and the copper bell originated in Mexico. The raised and painted design of the shell in the center, created by etching the material with acid, was made long before the technique became known in Europe in the 1400s.

lines resembling snakes. Impressive sculptured stone objects, including fine bowls decorated with figures of lizards and humans in relief, were laboriously cut from hard crystalline rock.

It would be a mistake to imagine that the Hohokam scraped a bare level of existence from the desert, clinging grimly to a precarious way of life.

But even the most basic facts of Hohokam history—where they came from and what happened to them—are unresolved and provoke fierce controversy. Indeed, few other topics in North American prehistory have generated so much theorizing based on so little hard evidence. Compared to work on the ancient Pueblo or Anasazi cultures to the north, research on the Hohokam has lagged behind. (A few years ago, the leading Hohokam scholar, Emil W. Haury, commented that “Hohokam studies in 1978 are about where Anasazi investigations were in 1940.”) The absence of romantic ruined cliff dwellings like those of the Anasazi, not to mention the grilling heat experienced by excavators in the desert, partly explains why fieldwork has not been more active in southern Arizona.

During the past 10 years, however, numerous surveys and excavations have been undertaken in advance of power lines and water management projects in the region. The most ambitious study, completed by the Arizona State Museum in 1982, was a three-year investigation involving no less than 45 Hohokam sites, all threatened by construction of the Central Arizona Project’s huge aqueduct linking the Salt and Gila valleys.

As a result of this and other salvage digs, an exciting reappraisal of the Hohokam has begun. It is now clear that they pursued a far more complex way of life than many scholars had previously assumed. Their abilities and originality have been consistently underrated, generating much confusion. Although frustrating gaps and unresolved questions still linger in the Hohokam record, a new picture of these enterprising desert farmers is emerging from the unwritten past.

Who were the Hohokam? The traditions of the present native inhabitants of the region, the Pima and Papago Indians, are of little help, since only a few brief legends refer to their predecessors. “Hohokam” is a word meaning simply “all used up.” (The Pima refer to a

Los Muertos in the Salt River valley was a mile-long settlement with 25 separate building compounds

car with one punctured tire as “hokam”; with two tires gone it would be “hohokam.”) Often the use of the term by archeologists has been equally vague. To some researchers it has meant a shared tradition of pottery styles and other material objects, while others have understood it to designate a single population.

In fact, the question of whether the Hohokam were one or several different peoples sharing common items of trade remains a perplexing issue. Since it is difficult to guess ethnic identities from archeological remains, most scholars now use “Hohokam” in the sense of an entire “regional system,” defined by local characteristics of geography, subsistence and material culture.

However it is interpreted, the Hohokam phenomenon has always loomed large in attempts to understand the prehistory of Arizona. The earliest studies were conducted by the pioneer anthropologist Frank Hamilton Cushing, leader of the first major American archeological project, the Hemenway Southwest Archeological Expedition. In 1887, Cushing arrived at the site of Los Muertos in the Salt Valley, where he was confronted by a mile-long settlement composed of 25 separate building complexes or “compounds.”

Admiring “the prodigious industrial energy” of the Hohokam, Cushing camped at the site for 15 months, mapped the networks of canals and collected thousands of artifacts. While his digging methods were undeniably crude, Cushing anticipated the modern interest in Hohokam subsistence by recovering the first archeological specimens of beans, corn cobs, mesquite pods and other vegetable remains, which are still preserved in the Peabody Museum of Harvard University.

Until the 1930s, however, the ruins in the desert were assumed to be merely a variation of Pueblo culture farther north. The distinctiveness of Hohokam ar-

tifacts from those of the Anasazi was only recognized after extensive surveys undertaken by the research institute of Gila Pueblo. Its founder, Harold S. Gladwin, devoted his private fortune to establishing the distribution and sequence of Hohokam remains.

The climax of his researches came in 1934-35 with the excavation of the most famous site of all, Snaketown, in the Gila Valley. More than 200 house ruins were unearthed there, along with many ceremonial structures. The unexpected richness of Snaketown added new dimensions to the Hohokam picture, notably the recognition of its earliest phase, the Pioneer period beginning around A.D. 350, and the recovery of a few exotic items such as copper bells and mosaic mirrors of iron pyrite that must have been imported from Mexico.

Gladwin summed up the Snaketown campaign by asserting that “it provided convincing proof of the importance of the archeology of southern Arizona for those who heretofore had wondered if such a people as the Hohokam had ever existed.” While scholars today are agreed on an overall pattern of events in Hohokam prehistory, the significance of these events presents a series of intriguing problems. For example, where did the Hohokam come from?

For many decades, Haury, who had been Gladwin’s young assistant, was firmly convinced that their origins were to be sought in the immediate vicinity: the Hohokam, he believed, had developed in a smooth transition from a local hunting culture known as Cochise. After his return to Snaketown in 1964, however, Haury changed his mind. Innovations of the Pioneer period, such as the appearance of pottery bowls and figurines, were traceable to Mexico. Haury theorized that they were due not simply to casual contacts resulting from trade, but to the migration of a distinct group of people from somewhere in northern Mexico who also brought with them an irrigation technology.

Critics of the migration scenario, Fred Plog of New Mexico State University for one, point out that the only evidence during the Pioneer period is a single “canal” excavated by Haury at Snaketown. “This channel lacks the attributes of a canal and may actually have been a natural arroyo,” says Plog. In any event, it can be argued that Hohokam farming practices evolved over several centuries, rather than being introduced “as a package” from Mexico. Whatever

Can the centuries-long experience of the Hohokam, whose past lies buried beneath modern Phoenix, be ignored?

By Fred Plog

Phoenix and its suburban area encompassing Tempe, Scottsdale and Mesa, with a population of more than one-and-one-half million, comprises one of the most rapidly growing metropolises in the country. Sustained only by transportation ties that bring food, dams and canals that bring water, and power that is produced on the plateaus hundreds of miles away, this urban complex covering 9,253 square miles may well be described as a modern miracle arising in the southern Arizona desert. Can such an enterprise be sustained? Better yet: What do we need to know to sustain it?

The history of our own society, barely 100 years old in the southwestern deserts, does not provide answers. In lesser time than this, desert cities all over the planet have failed. Those that have lasted for centuries are relatively few. One group of desert people with more success were the Hohokam, whose archaeological remains lie buried beneath the Phoenix metropolis, and who mastered the difficult environment of the southern Arizona desert for at least ten centuries, and perhaps much longer—from 300 B.C. to A.D. 1450.

Surely, such a record of success—but of ultimate failure—can provide important clues to the problems that modern inhabitants of the area are facing now and

must confront in the future.

Differences in technology between modern society and the ancient Hohokam are not so great as one might think. A simple example: The thick, adobe-walled buildings of the Hohokam are increasingly being copied as a means of maintaining even temperatures—"passive heating/cooling"—in the sometimes torrid, sometimes frigid desert.

Even more notable: The very water supply on which the modern metropolis depends is fundamentally the one that served the Hohokam. Omar Turney, an amateur archeologist who made major contributions to our understanding of Hohokam life, was the first Phoenix city engineer. He was hired to build a water supply system, and recognizing the importance of the centuries-old remnants of Hohokam canals, he modelled his system on the pattern of ancient channels.

What else can be learned from these resourceful people of the past? Water, salt and people are pivotal concerns.

Floods: Even in a desert, the variation in water flowing through the rivers is enormous, and in the last decade, Phoenix has experienced several "hundred year floods." With only a hundred years of stream flow records for the area, however, the extent of a genuine hundred year flood is unlikely to

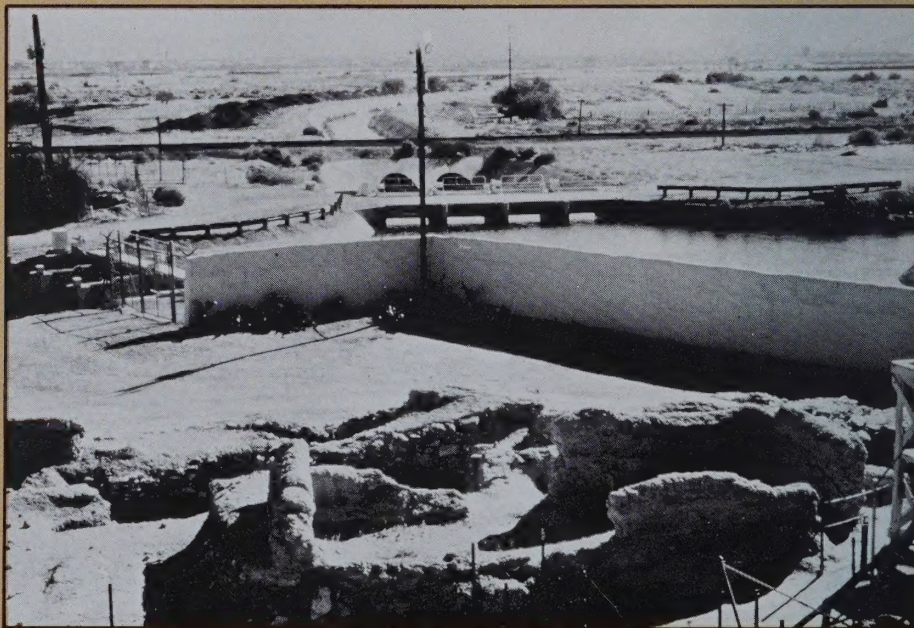
have been recorded. In fact, farther from the present-day river channel than any modern flood has reached are Hohokam sites containing dense silt layers left by flooding. It is quite likely that these prehistoric sites contain the very record of flooding that modern residents should be aware of to prepare for a truly major flood.

Drought: The Central Arizona Project is a canal system being built to bring Colorado River water to Phoenix and Tucson. Tunnels have been drilled through mountains, and concrete-lined channels excavated across the desert. But will there be enough water? Extending back into Hohokam times, records compiled in the Southwest of tree-rings, which are formed annually and vary in thickness proportionate to yearly precipitation, suggest a problem. If these records are correct, Arizona and the other western states drew up their plans to divide the waters of the Colorado River on the basis of the two wettest decades in centuries.

Salt: Desert rivers are often saline—the Salt River of the Phoenix area is not casually named. In desert environments, soils are also fragile. When large volumes of water are dumped on them, these soils trap the salts. In large quantities, salt poisons plants. Today, residents of the area routinely purchase

The 1,000-year-old Hohokam site of Pueblo Grande, located in a Phoenix suburb, is owned by the city and maintained as an archeological monument. Seen beyond the protective wall is a canal which has fed water from the Salt River to Phoenix since the turn of the century. It cuts across a network of ancient irrigation channels (shown in map on far right).

Photo: U.S. Bureau of Reclamation



chemicals to offset the ubiquitous yellowing of lawns and shrubs caused by chlorosis or salt poisoning. The government spends millions of dollars each year to remove salt from downstream canals whose waters are poisoning fields along the Mexican border.

One early theory of the Hohokam demise focused on salt. Maps of their canals correspond closely with charts of the Phoenix area today showing where soils are strongly alkaline—heavily saturated with soil salts. Studies of prehistoric pollen suggest that Hohokam peoples during the later periods may have grown salt-loving plants in their agricultural fields to avert impending catastrophe.

Salt may not have been the only cause of the Hohokam demise, but it almost certainly contributed to this society's collapse. Which Hohokam groups overcame the salt problem? And how? The answers to these questions could provide the solutions to a major problem in the Southwest.

People: How many Hohokam lived in southern Arizona? Emil Haury, dean of Hohokam scholars and ever the conservative, estimates that there were 60,000. If Haury will go this far, 100,000 prehistoric residents is not improbable, and one million is not impossible. Whatever the total, the Hohokam world was not one of

tiny villages, but of towns and cities. Packing so many people into a small area made conflict inevitable. The situation today is instructive.

One local group claims that the problem of the desert is the continued use of water to sustain farms that produce benefits for only a few, with an enormous resulting waste of precious water. According to others, the plush lawns and swimming pools are an equal waste. From a third perspective, the cities themselves are expanding on some of the best agricultural land to be found anywhere in the Southwest.

Prehistoric peoples in the Southwest rarely built settlements on their best farming land. Eventually, the Hohokam violated this rule. Dispersed neighborhood residences were replaced by apartment-like complexes. Centralization of wealth and power increased. Too many people? Too little land?

One of the lessons that could be learned from the Hohokam past may well be summed up in the words of Pogo: "We have met the enemy . . . and he is us."

Fred Plog is a professor in the anthropology/sociology department at New Mexico State University, Las Cruces, specializing in the prehistory of the Southwest.

the truth about their roots, the early population of the Hohokam was certainly small.

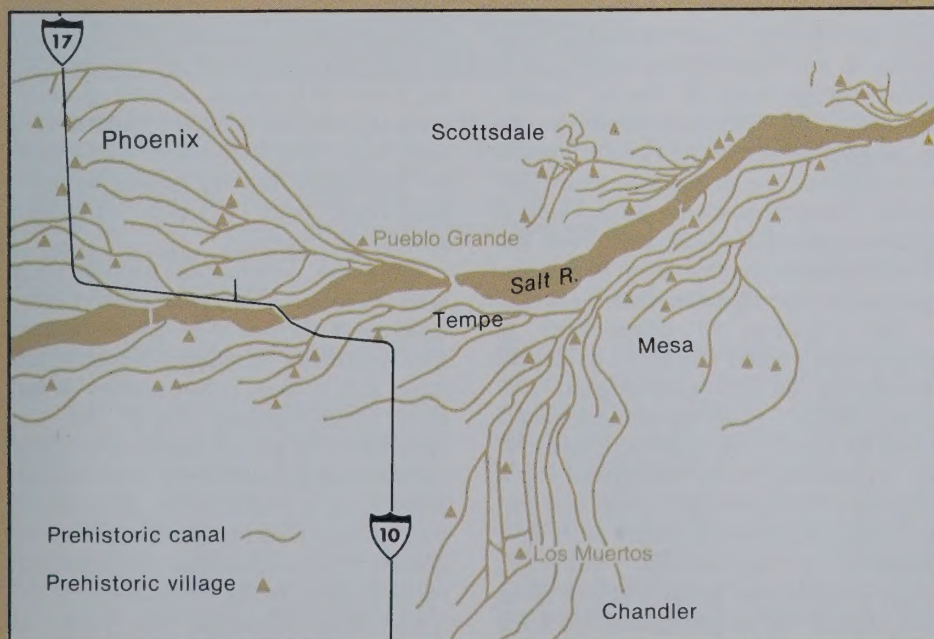
Circumstances began to change around A.D. 600, the start of the so-called Colonial period. As the name implies, Hohokam sites now flourished not only in the core region of the Salt and Gila rivers, but in virtually all of the major valleys of southern Arizona. Typical artifacts and structures even appeared as far north as Winona near Flagstaff and as far east as Stove Canyon at Point of Pines.

This remarkable growth was probably related to trading activities. During the Colonial period and the later Sedentary, the long-established crafts of the Hohokam reached their peak. Large occupation sites dedicated to producing shell objects were recently identified in the present-day Papago reservation bordering on Mexico. The quality of this shell jewelry and of Hohokam stone bowls and pallets was never surpassed by any other southwestern culture.

A further sign of intense trade activity is the presence of Mexican imports in the major Salt and Gila sites. They took the form of exotic items—"status symbols" perhaps—such as copper bells and "mirrors" consisting of iron pyrite pieces pasted together over a stone base. While these few Mexican objects naturally arouse speculation, they were not the only foreign goods to pass through Hohokam hands: raw material for the shell pieces came from the coast of California, and turquoise from Pueblo neighbors to the north.

This vigorous artistic and economic growth was matched by an increasing complexity in Hohokam society itself. Snaketown grew from an obscure village of a hundred people to a thriving center of perhaps a thousand, many of whom were engaged in pottery production. Their pithouse dwellings were no longer arranged at random, but placed in more orderly fashion around rectangular plazas, each cluster perhaps corresponding to important families.

At the major sites, a new emphasis on



ceremony arose, with flat-topped mounds erected, presumably to support the residences of Hohokam elite. "Ball courts" were also built which could have served for ritual dances as well as for sport. While the inspiration for the mounds and ball courts could well have derived from Mexican ideas, these public monuments developed over the course of many centuries among the Hohokam. They were clearly a product of tradition rather than the sudden arrival of an architect from Teotihuacan or Tula.

At its peak around A.D. 1000, the Hohokam phenomenon embraced a vast area of 10,000 square miles, including most of central and southern Arizona. By the middle of the 12th century, unknown circumstances led to a drastic reduction in the area of settlement. An understanding of these events remains one of the most challenging problems of study in the Southwest.

The outlying tributaries were abandoned by the Hohokam, while even in the Salt and Gila homeland a number of important sites (including Snaketown) were deserted. However, other sites there seem to have received a new influx of settlers. Irrigation projects continued on an ambitious scale, but Mexican items disappeared, and Hohokam artifacts began to display more variety in style from one region to another.

Another striking change during this Classic period occurred in domestic building patterns. The traditional pithouse now appeared side-by-side with above-ground buildings, solidly constructed from sun-baked mud reinforced by wooden posts. They were organized in groups and enclosed by walls. Platform mounds were also built on a grander scale. Both innovations perhaps reflected a concern by Hohokam leaders to reinforce their central authority in the face of some kind of threat or stress. A brief economic rebirth in the 14th century, in the latter part of the Classic period, saw the building of multi-storied "great houses" such as the Casa Grande.

Only a few years ago, the ebb and flow of Hohokam fortunes during the Classic period were confidently assumed to be due to migrations of foreign cultural or ethnic groups, but this is now questioned. The appearance of above-ground buildings, for example, was always taken as a distinctive hallmark of the Classic. Yet fresh excavations suggest that the vari-

***Dug with wooden sticks,
Hohokam canals
were as deep as six feet
. . . a single channel
irrigated up to
25,000 acres***

ety of architecture in earlier periods has been underestimated. At sites in the Gila Valley, a team of the Salt-Gila Aqueduct Project recently unearthed above-ground buildings and unusual types of pithouses, all dating to the Colonial period.

Another popular theory emphasizes the impact of Mexican trade and religion on affairs in the southwestern U.S. Here the evidence seems more substantial. Many Hohokam ball courts, for example, have three stone markers spaced equally along the axis, a feature characteristic of Mexican courts. Several leading experts on northern Mexico archeology, notably the late Charles DiPeso and J. Charles Kelley, proposed that the Hohokam not only traded with the frontier peoples of Middle America, but that Mexican priest-merchants were actually present north of the border to take charge of the commercial and spiritual affairs of the Hohokam. Others argue that the links with Mexico suggested by evidence such as the ball courts resulted from indirect trading contacts rather than the actual presence of outsiders among the Hohokam.

Indeed, the approach currently most in vogue among southwestern scholars today is to explain Hohokam events mainly as the work of "inside" forces. Basically, the Hohokam were not an egalitarian people as the Pima or Pueblo communities are in historic times. Instead, there appears to have been a gradual rise of "chiefdoms," with the leaders gaining prestige from their management of an expanding trade network.

The existence of priest-chiefs is suggested by many strands of evidence, notably by the Casa Grande itself. Detailed studies of the monument supervised by David Wilcox of the University of Arizona lead to the conclusion that it may have been a chief's residence. For example, the authorities there must have commanded considerable influence, since construction wood totalling some 640 beams had to be fetched from the

mountains more than 50 miles away.

Recent archaeoastronomical studies confirm an old Pima legend that the building was also an astronomical observatory. "Portholes" directed toward sunrises and sunsets at key dates in the solar calendar suggest that the chief may have exercised power through a cycle of ceremonies based on a carefully regulated calendar, similar to the practices of Hopi and Zuni sun priests a century ago.

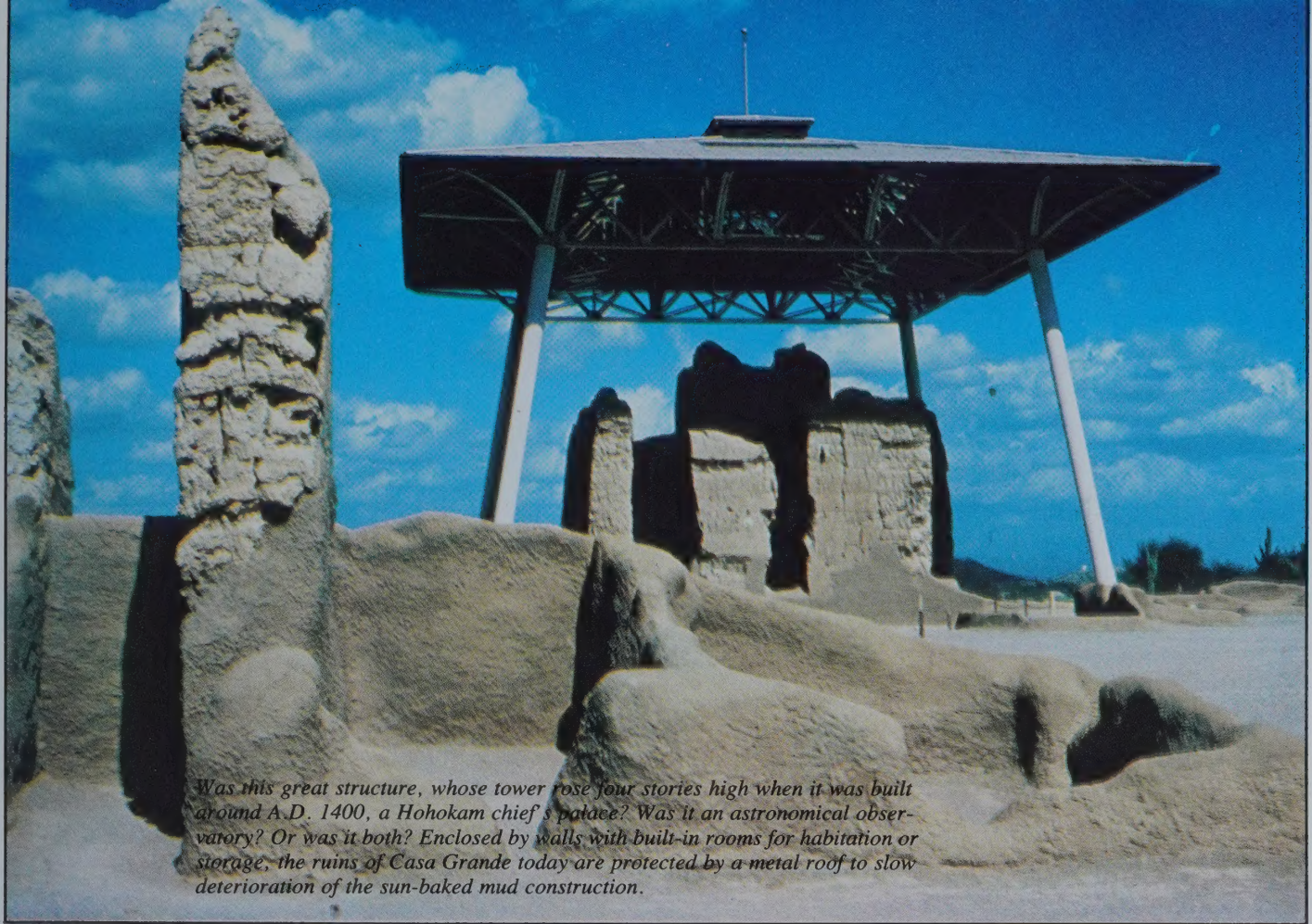
Long before the Classic period, the population of major sites seems to have included a privileged class, since grave goods are unevenly distributed among the burials in Hohokam cremation cemeteries. The canal systems are another important source of evidence. Some of the networks were so complicated that they may well have required a managing authority, with one village exerting control over the water rights of another.

The author of a recent study of Hohokam irrigation, W. Bruce Masse of Southern Illinois University, believes that coordination was necessary not only between single canal systems, but between *all* the systems in the Salt Valley.

The scale of the Hohokam waterworks was remarkable, with as much as 25,000 acres served by a single canal. When one considers that many canals were six feet deep and 15 feet wide, and that the engineers worked with wooden digging sticks, their achievements seem prodigious.

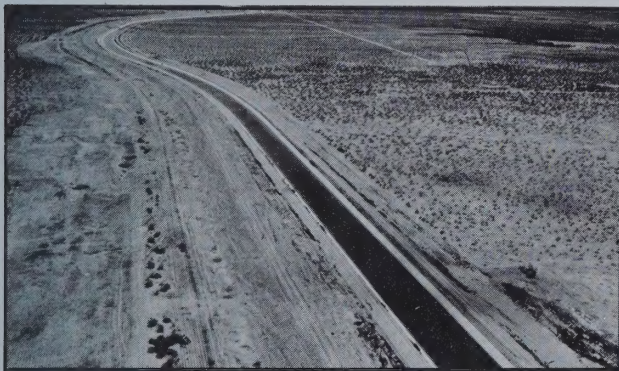
But the unique irrigation systems distract attention from many other subsistence methods available to the Hohokam. Until recently, small game hunting and wild plant gathering were important food resources for the Pima. The midsummer harvest of saguaro cactus fruit, for example, offered an insurance against the possible failure of a corn crop. The Pima made cakes from the pulp of the fruit and ground the seeds into flour, both of which were high sources of protein.

Of course, comparisons must be made with caution. (The present-day Pima have never claimed to be descendants of the Hohokam, although archeologists think this is likely.) But studies of ancient plant remains reveal that the Hohokam did gather many varieties of cactus, besides cultivating corn, squash, beans, cotton and tobacco. In addition, they probably encouraged the growth of certain weeds such as goosefoot and pigweed in their fields, since these plants were also processed as foods at



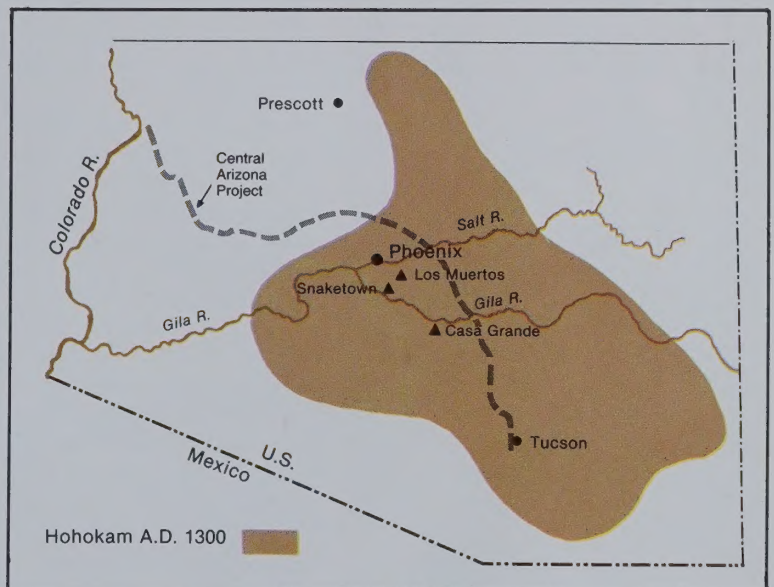
Was this great structure, whose tower rose four stories high when it was built around A.D. 1400, a Hohokam chief's palace? Was it an astronomical observatory? Or was it both? Enclosed by walls with built-in rooms for habitation or storage, the ruins of Casa Grande today are protected by a metal roof to slow deterioration of the sun-baked mud construction.

Photo: U.S. Bureau of Reclamation



Modern society's solution to dwindling groundwater in central Arizona is a 300-mile-long artery of channels like this to carry water from the Colorado River to Phoenix and Tucson. Archeologists have found over 200 prehistoric sites facing destruction or disturbance by the project, most of them within the Hohokam culture area (see map).

Photo: U.S. Bureau of Reclamation



Hohokam sites along with domesticated crops.

Recent surveys have also shown the importance of other farming methods besides canal irrigation. During the past decade, the evidence of dry farming techniques, such as terraced fields, bordered gardens and stone check-dams, has begun to appear not only in outlying regions but even in the major river valleys, located close to canal systems. The

Hohokam obviously adopted multiple farming strategies in a wide variety of settings. Presumably, this was done to reduce risks, and to exploit the potential of the landscape to the fullest.

One of the most persistent notions about the Hohokam is that they were a people under pressure. Such stresses as a growing population and a worsening environment are usually depicted as vital factors responsible for changes in their

prehistory. However, the new direction taken by studies of their subsistence raises the question of whether they were really so badly off. Recent surveys show how vast areas of the Salt and Gila valleys with abundant and varied resources were never exploited as they might have been if population pressures were truly a problem.

At the same time, the role of environmental change in the striking reduction

Clues from the modern-day Pima

Until recently, Pima Indians living in the Gila River valley gathered the fruit of the wild saguaro cactus, as the Hohokam probably did before them. Insuring against possible failure of the maize crop, the saguaro harvest was an important focus for midsummer social and religious gatherings of the Pima.

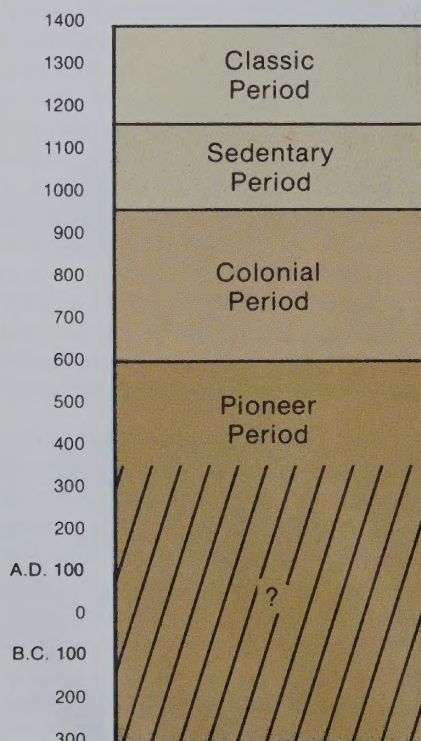
Syrup extracted from the saguaro fruit (shown in closeup) was used as a sweetener, or fermented as an alcoholic drink—as the Pima woman on the right is doing. Pulp of the fruit was made into cakes and the seeds ground into flour, providing a rich source of protein.

Plant remains in sites of the ancient Hohokam indicate that they, too, harvested the fruit of the saguaro. While it is likely that many aspects of recent Pima life are different than those of the distant past, records of how the Pima lived inspire researchers with ideas that can be tested for the Hohokam.

Photos: U.S. Bureau of Reclamation



Hohokam Periods



in area occupied by the Hohokam during the mid-12th century (the start of the Classic period) is not at all clear, although evidence from ancient tree rings and pollen does indicate a generally drier phase of climate in the Southwest at this time.

In a similar way, the 15th century is known to have been a time of cultural and climatic change in the Southwest, yet the reasons for the Hohokam decline are not obvious. They must have experienced such stresses before, and the real question is why the Hohokam did not adapt to or surmount their difficulties this time. Unfortunately, the archeological record between about A.D. 1400 until the arrival of the Spanish is practically a blank.

Assuming that funds are available, archeological excavations and surveys will soon make up the lag in our knowledge of the Hohokam compared to that of other southwestern cultures. This promises to be exciting, for with growing insecurity in our own handling of environmental problems (see sidebar), the study of the Hohokam is not an empty, sterile academic pursuit—a thing of the past.

To explain the changing pattern of events in the Hohokam prehistory, including their eventual failure, we first have to understand their success in settling the Sonoran Desert continuously for nearly 2,000 years. This is a record of stability and flexibility which we, from the hindsight of our own culture, may well envy. ☼

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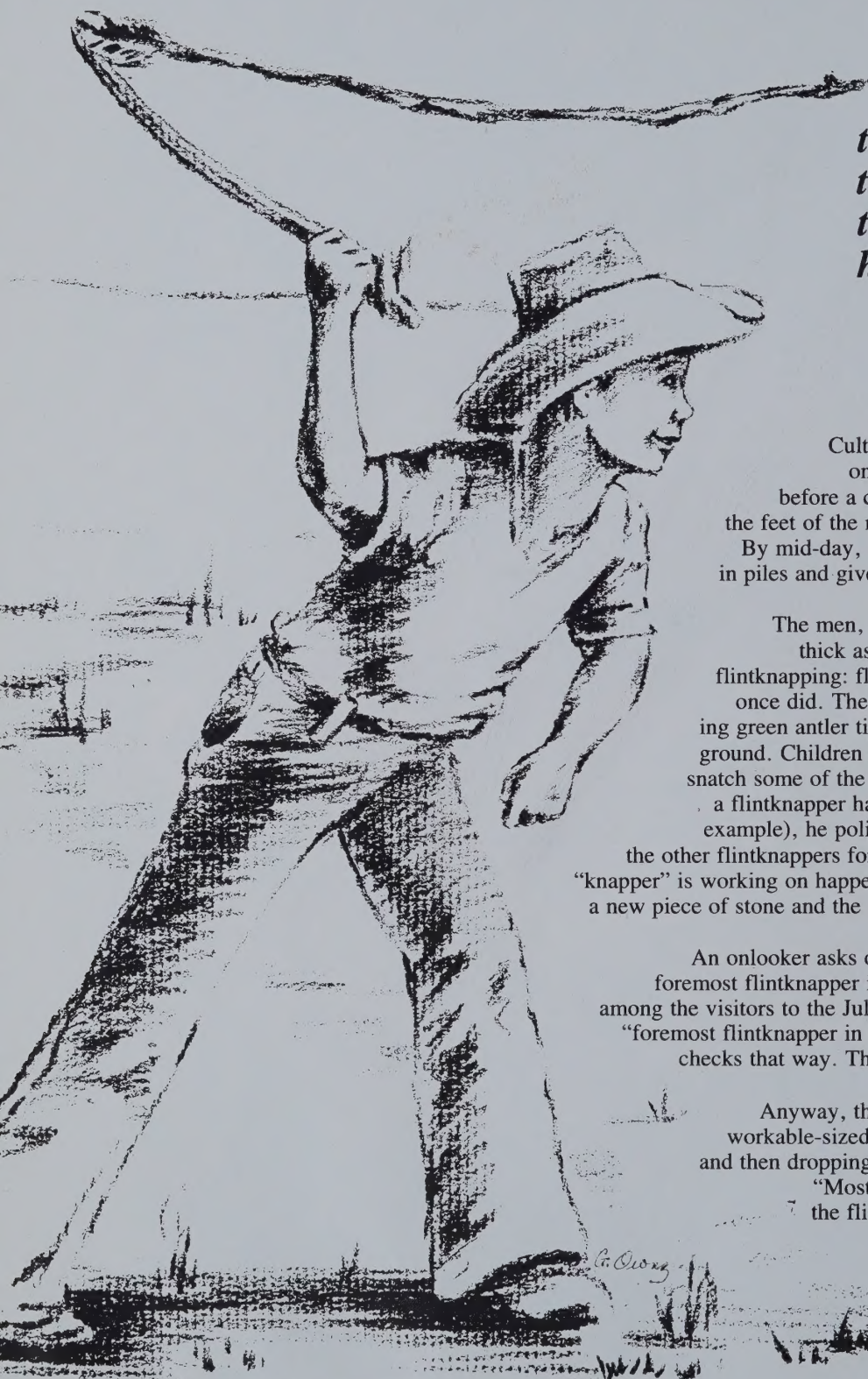
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Excavated from a ceremonial plaza at the Fort Lowell site within the city limits of modern Tucson, this Hohokam flower-patterned bowl dates to the Colonial Period (A.D. 1200-1400).

Saratoga, Wyoming (Pop. 2,410): Atlatl Capital of the World



For a day each summer, this unlikely cattle country town revives the lost art of the prehistoric mammoth hunters

By C. J. Box

Seven men on stools and metal folding chairs sit behind a thigh-high nylon rope, their backs to the white walls of the Saratoga Historical and Cultural Center. Each looks down, concentrating on his scarred and calloused hands, showcased before a crowd of spectators beyond the rope. Around the feet of the men, flakes and chips of stone catch the sun. By mid-day, obsidian and flint fragments litter the ground in piles and give the effect—from a distance—of men working in a shallow pool of sparkling water.

The men, some of whom have professional resumes as thick as a Montgomery Ward's summer catalog, are flintknapping: flaking stones into tools as prehistoric peoples once did. They hold the stones between their knees, working green antler tips on the surface, and more flakes fall to the ground. Children among the spectators dip beneath the rope to snatch some of the chips and put them into their pockets. When a flintknapper has completed a point (an Eden spearhead, for example), he polishes it with a leather rag, shows it around to the other flintknappers for comments, and starts a new one. If a tool a "knapper" is working on happens to break or flaw, it is quickly replaced by a new piece of stone and the mistake goes into hiding. Flintknappers have a great deal of pride in their work.

An onlooker asks one of the men: "Are you Bruce Bradley, the foremost flintknapper in the world?" Bradley's name has circulated among the visitors to the July 17th Fireside Folk Festival, and the phrase "foremost flintknapper in the world" is spoken as if Bradley signed his checks that way. The flintknapper shakes his head, and indicates that Bruce Bradley is farther down the row.

Anyway, the visitor asks, is it true that Indians obtained workable-sized materials for tools by heating rocks in a fire and then dropping them into cold water so they would shatter?

"Most archeologists agree that it never happened," the flintknapper responds. "Early man simply used the right sized material for the job because heating and cooling causes fissures in the stone. It cracks."

The "hot rock myth" seems to be something most of the professionals present enjoy discounting. Another victory for archeology. Another victory for the Fireside Folk Festival.

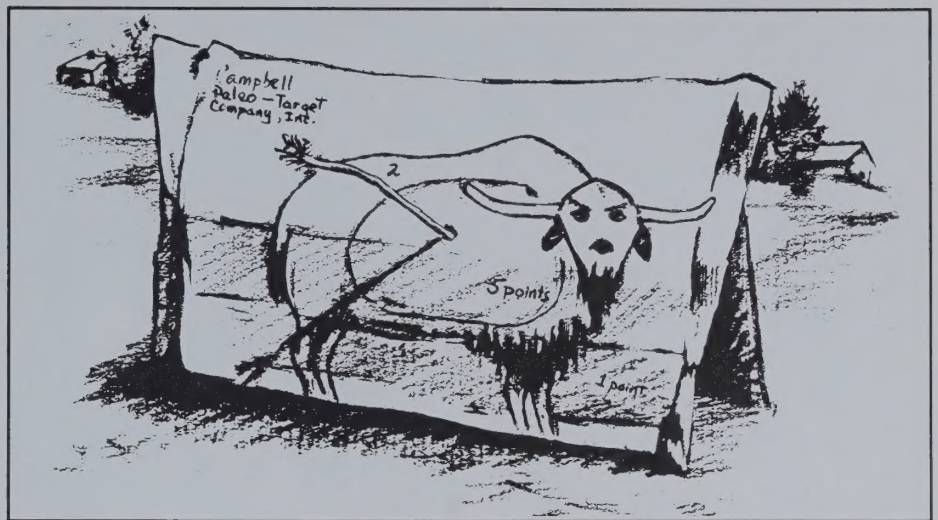
Even the pros bowed to the prowess of 11-year-old Brian Benson, using an impossibly crooked spear, in the main event.

The onlookers in this scene, drawn from events that took place in the tiny southeastern Wyoming community of Saratoga last summer, were not by any means archeology buffs. Most had come for the festivities, which included a parade, a 10-kilometer run, a spear-throwing contest with atlatls, a large-scale trout fry put on by the local Lions Club, and a street dance later that evening. They stood at the rope like tourists do in a glass-blowing shop in a resort town, holding Cokes and babies, wearing sunglasses and cowboy boots.

Some watched the flintknappers for awhile, figured out that these guys were whacking away at rocks, and went to get another piece of fried fish. Others, however, practically all of whom had no background or specific interest in early man or aboriginal tools before that day, stood transfixed—almost hypnotized—by the clean symmetrical shapes of the spearheads and the rhythmic method of the work. Often, an onlooker recognized a spearhead turned out by a flintknapper as similar to one he or she had at home in the dresser drawer or behind glass on the wall.

Most related to the goings-on behind the rope as hunters, too. The valley in which they live along the North Platte River, at an altitude of almost 6,800 feet, is cattle country. Nevertheless, it's a way of life in the valley—bounded by the Snowy Range to the east and the continental divide 15 miles to the west—to hunt elk, deer and antelope in the mountains to get winter meat. Men who were experts with a high-powered rifle asked about the killing potential of stone points: how far they penetrated, how they were thrown, whether or not a heavy spear could compete with a bolt-action .30-.06 within 50 feet.

Some did not necessarily believe the flintknappers, who told how people liv-



ing in the valley around 10,000 or so years ago killed elephants with these stone weapons. But, still, the flintknappers made their points—in more ways than one.

The flintknapping and atlatl contest at the Fireside Folk Festival is an annual project of the archeological arm of the Saratoga Historical and Cultural Society. The prime mover behind the event is Ada Bouril Jackson, who lives on the edge of the North Platte River on the Saratoga Inn grounds. Her home is a testament to her activities since she retired several years ago: a spear and spearthrower in one corner of the living room, primitive pottery on bookshelves and tables, primitive art covering the walls, and other objects displayed that were collected during her travels in a Volkswagen minibus through North and South America and the sagebrush plains and mountains of Wyoming.

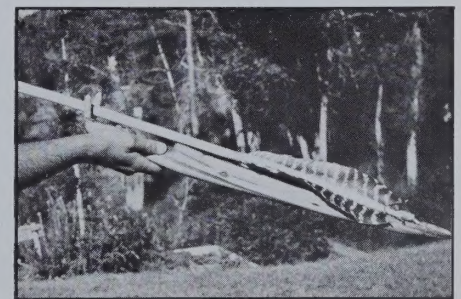
It was by her urging that the Folk Festival became literally a live, outdoor archeology exhibit. In addition to Bruce Bradley, she invited guests like Marie Wormington, writer and archeologist from Colorado; Waldo Wedel, archeologist emeritus from the Smithsonian Institution; George Frison, head of the anthropology department at the University of Wyoming and president-elect of the Society for American Archeology; and Robson Bonnichsen and Dennis Stanford, early man specialists from the University of Maine and the Smithsonian, respectively.

"The festival is meant to give publicity to archeology," said Ada, "and Wyoming needs it. Most people here think of archeology as collecting arrowheads, and that's the extent of it.

Even someone who digs up dinosaur bones is considered an archeologist."

Professionals who accept invitations to Saratoga each July are put on display. Like the flintknappers. Or, they might find themselves in competition, hurling spears with an atlatl at targets mounted on hay bales while spectators watch and cheer.

The spearthrowing competition is open not only to professionals, but local residents as well. Saratoga is undoubtedly the only community in the country where youngsters spend as much time on their spearthrowing as they do playing



The atlatl: a revolutionary invention

The atlatl (so-called from the Aztec name for the implement) was a spearthrower, which in effect increased the length of a hunter's arm and thereby imparted greater striking power and accuracy to a thrown spear. Invented more than 10,000 years ago, the implement had a revolutionary effect on human adaptations, just as the bow and arrow did millennia later. The atlatl made early man a more efficient hunter, increasing a band's protein supply, and reducing the amount of time needed for food gathering. Thus, the atlatl promoted an increase in the size and age span of the family unit, and eventually, it enabled early hunter-gatherers to form into larger and more complex social groups.

About the author:

C. J. Box is editor of *Southeastern Wyoming Sportsman*, a magazine extolling a region where "wildlife population is bigger than the people population."

basketball or manipulating video games. In their rooms, next to a poster for the Denver Broncos, many have atlats and spears they have made, using stone tools and materials they have collected in the mountains: lodgepole pine, willow and choke cherry wood, deer antlers, elk sinew, beeswax, turkey feathers and lichen (for dye).

The reason for all this enthusiasm is local sixth grade teacher Rod Laird, whose social studies classes are filled with heavy doses of knowledge about early man. By the time they reach seventh grade, the youngsters learn how prehistoric tools were made, how to prepare and cook basic and survival foods, when early humans wandered into the area and out of it, and most important, why it serves a useful purpose to learn concepts such as these.

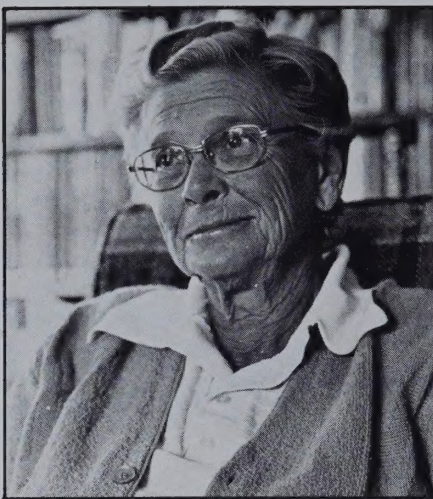
Many of the youngsters become surprisingly adept at the mechanics of using an atlatl to hurl a projectile. On the streets of Saratoga, riding their bicycles and wearing baseball caps, are kids who could zap you through the liver with a spear. Unquestionably, if mammoths ever wander by up the Platte River Valley again, they would be doomed.

It was one of these deadly sixth graders with whom the adult spearthrowers had to contend at the afternoon atlatl competition.

Bruce Bradley, earlier celebrated as "the foremost flintknapper in the world," was known in the atlatl circle as about the best around at that, too. The year before he had whipped the Smithsonian's Dennis Stanford. He won by hitting targets for accuracy and then distance, and was expected to walk off with top honors again. Several local men, including Laird, entered the competition. Although most denied it at the time, many of the adults had been practicing, hurling homemade spears at empty milk cartons in their backyards.

They were no match, however, for 11-year-old Brian Benson of Saratoga, a former student of Laird's. Brian won with an impossibly crooked spear and the ability to nail a fly to the inner circle of the target at 15 paces.

Later that night, at Chastain's Cedar Creek Ranch east of Saratoga where camping facilities were provided, the professionals gathered along with amateurs and anyone else interested to eat, drink and throw spears among themselves . . . without 11-year-olds.



Ada Bouril Jackson, prime mover behind Saratoga's early man celebration, lives in a home filled with mementoes of her international travels to study ancient man.

Photo by Candy Moulton

The campfire, fed with sagebrush to sear steaks and later with split pine, had a good smell as the sun set. Informal, fireside talk about early man took over.

Chuck Reher, archeology professor at the University of Wyoming, was the first of the professionals to shed light on why some of the visitors at the flintknapping exhibition seemed oddly mesmerized by it. "There is something about cracking those rocks into symmetrical shapes that is instinctive to many people," he said. "I think there is a genetic . . ." He paused, possibly treading thin ice in sweltering July.

After a moment he went on, however, venturing: "I think there is a genetic nature to it. Everyone loves arrowheads, the shapes of them. Remember, it was the primary technology for humans for thousands of years."

Explaining his "genetic" argument, Reher likened people to geese . . . and arrowheads to cardboard cut-outs of Peregrine falcons. Peregrines are the natural enemy of geese and can hit a rising bird hard enough in the air to kill it, and then pick up the goose before it hits the ground. When goslings never in the wild, and therefore never exposed to Peregrines, were shown cut-outs in tests, said Reher, the goslings reacted. They tried to run and hide and would not try flight, where they would be vulnerable. Along the same line, he said, people see the arrowhead shapes and the manufacturing of an implement and react favorably.

"The arrowhead shape, like a cut-out of a falcon to a gosling, stirs something

in some modern people that has been buried and lies dormant," said Reher.

Reher acknowledged the value of the archeological aspects of the Folk Festival for the science as a whole. "Anything to get public awareness is valuable. We (archeologists) often spend too much time contending with the federal government and bureaucracy and neglect the need to reach out to the public."

Flintknapper Bruce Bradley expanded on the theme: "Archeologists take themselves too seriously."

Bradley is about five-feet-six and as skinny as a rail. He wears tinted glasses and has a mustache, and looks like the type of person who spent his childhood building models and reading books and taking long hikes by himself. Receiving his PhD from Cambridge University, Bradley has done field work in France and Lebanon. He lives now in Cortez, Colorado, and works for a company called CASA (Complete Archeological Service Association).

When explaining his flintknapping skills, which are utilized by a number of universities and museums in carrying out their research, the word "genetic" pops up for the second time that day.

"Flintknapping is an acquired skill," said Bradley. "Lots of people . . . it doesn't click with them. With me, when I was no higher than that sagebrush, I was collecting rocks. Then I started banging them together. It was basically genetic, a compulsion."

"While we were at the Folk Fair, people would ask, 'How do you do that?' Few would ask why."

Later, Bradley spoke of finding spearheads in the Southwest he instinctively "knew" were made by the same craftsman. Studies and testing eventually proved they were.

"The experience of it all gives an insight to what went on in the past. While I'm knapping (and while people are watching) thoughts are in concepts, not in English words. It's very basic. I can come as close to getting into the prehistoric mind as possible."

"Archeology is an art as well as a science," Bradley concluded, "and people at the Folk Festival who find themselves fascinated watching the flintknappers can come to understand that." ☼

You're invited . . .

The Saratoga Folk Festival in 1983 will be held July 14-16. For more information, write: Archeology, Box 703, Saratoga, WY 82331.

Pieced together from sherds excavated at Fort Michilimackinac, this fine porcelain saucer was exported from China to Europe, then shipped to Montreal and carried by canoe and backpack to northern Michigan.



China at Mackinac

By Eugene T. Petersen

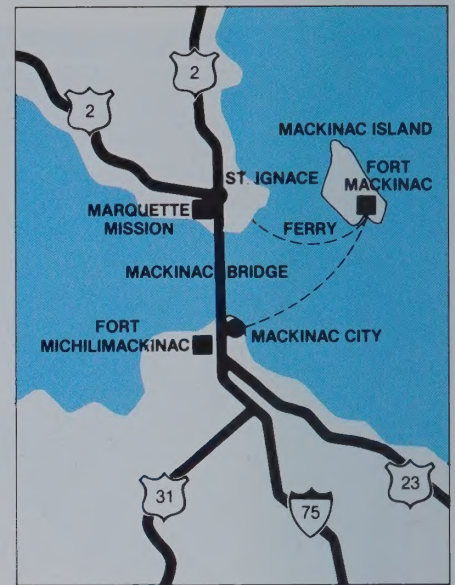
When Vice-Premier Teng Hsiao Ping visited the United States four years ago, he did not stop at Mackinac. It is doubtful if he ever heard of Fort Michilimackinac in northern Michigan, but if he had, Teng would have been fascinated by a connection between his ancestors and the Upper Peninsula's first English residents. Recent archeological excavations there have uncovered sherds of high quality porcelain teacups, saucers, bowls and platters made in Chinese factories in the early 1700s. Used, broken and discarded two centuries ago, the

pieces of porcelain were restored and exhibited for two years at Fort Michilimackinac in a special show appropriately called "China at Mackinac." Bearing witness to a certain lifestyle, the excavated porcelain changes our understanding of life in the untamed wilderness of North America, long before the colonies emerged as a nation—demonstrating an unexpected level of refinement.

Fort Michilimackinac was built by the French in 1715 in the shadow of the Straits of Mackinac. It was taken over by the British in 1761 and then abandoned

during the American Revolution when the English garrison moved to nearby Mackinac Island. Located 450 miles from Montreal and one of the most remote outposts at that time, Michilimackinac was the most important fur trading and military enclave in the upper Great Lakes.

The fort was also a principal center of French missionary activity for Jesuit priests proselytizing among the local Indians. Its residents, approximately 150 in number, included both poor French farmer-artisans and English fur traders. The French were descendants of the



Excavations at Fort Michilimackinac in 1976 revealed a row of French traders' houses dating to 1715-1761. Restorations of the later British fort are in the background—St. Anne's church, a soldiers' barracks and parade ground.

original peasant immigrants sent by an autocratic French government to colonize the Straits of Mackinac. The English, on the other hand, were middle-class merchants like John Askin and Ezekial Solomon, who, with the post's military officers, transplanted their European cultural tastes deep into the continent.

Unlike France, which largely wrote off its North American colonists following the defeat in 1761, Britain retained strong ties with her remote fur trading posts. The 35-foot canoes that carried beaver pelts east also brought the comforts of English life west.

Two hundred years after the British occupation of the fort, reconstruction was begun in 1960 by the Mackinac Island State Park Commission, based on historical maps, letters, official reports and the findings of staff archeologists working at the site. Excavations revealed stone foundations from the church, military buildings and many of the original private homes. Nearly one million artifacts—lost or discarded by the fort's residents in backyard dumps and privies, between stone fireplace hearths, and along the stockade walls—were uncovered in the excavations. Among these artifacts were 5,000 sherds of pottery known as Chinese export porcelain.

China scholars believe that porcelain

originated sometime during the Tang dynasty (A.D. 618-907), when the Chinese discovered that a mixture of kaolin clay and petuntse, a quartz stone, produced a hard glaze when fired at 1750 degrees Centigrade. The principal porcelain factories were at Jingdezhen, 400 miles north of Canton.

Trade with the west began modestly in the early 1500s, but the delicate porcelain quickly became popular with middle and upper-class Europeans. Soon the floodgates were open, and oriental porcelain reached Europe in ever-increasing amounts. When the East India Company's ship *Prince George* returned to Liverpool in 1755, it carried 26,000 blue and white cups and saucers, an equal number of plates, 402 complete dinner services and 200 tea sets, besides the usual consignment of tea and spices. For Europeans, Chinese dinnerware had become a hallmark of wealth, class and comfort.

Although western civilizations had been firing clay-based pottery for thousands of years, the porcelain that came from China was in a class by itself. Europeans marvelled at its delicacy, hardness and translucence. The underglaze scenes painted in blue by Chinese artists became familiar landscapes—broad-petalled peonies and graceful willows bending gently in a summer breeze, or heavily pruned and gnarled

trees dominating a tranquil garden scene. Petite tea houses, multi-storied pagodas, heavily laden cargo junks and flag-decked pleasure boats were other popular motifs. Sometimes human figures were depicted—a coolie straining under a load suspended from a shoulder yoke, a sailor navigating a junk, a farmer working in a garden. These scenes became so recognizable that long after European and American potters learned to duplicate porcelain, they decorated it with oriental subjects in a pattern universally known as "blue willow ware." So ingrained did Chinese porcelain become in the western market that "china" is still the generic term for ceramic dinnerware.

English law prohibited American colonists from trading directly with China, so all porcelain used in North America prior to 1781 arrived via European ports. Shipments to Michilimackinac would have required a complicated combination of transport by ship, canoe and overland routes. But this did not deter the transplanted Englishmen from bringing articles and materials which closely approximated an English lifestyle—and Chinese porcelain was clearly part of the lifestyle they wanted to maintain.

In the excavations at Michilimackinac, most of the Chinese porcelain was found in levels dating to 1760-80, which correspond to the British occupation.

Marked porcelain is rare among the uncovered artifacts, but one of the sherds from a saucer base was found with two Chinese characters. John Cope, director of the Freer Art Gallery in Washington, D.C., examined the characters and reports that they are meaningless—probably painted for artistic purposes only.

Michilimackinac's porcelain was made during the Qing dynasty in the early 1700s. The quality of the porcelain and the artistry of the oriental painters are impressive, yet the porcelain also makes some important statements about its owners. The fact that these delicate pieces could be transported from England to Montreal and then by canoe and backpack over numerous portages to the fort is remarkable testimony to the priority placed on these cultural trappings in a wilderness outpost. If the occasional visitor to Michilimackinac assumed he had left the social graces behind, he soon learned otherwise. Lyle Stone observed in his *18th Century Ceramics at Fort Michilimackinac* that the fine china differed not at all from that used in the At-

lantic seaboard colonies.

Literary and archeological evidence reveal other examples of the refinements maintained by important people at the fort. Forming the upper class, officers and wealthier merchants had money and were able to enjoy many of the same comforts of life known in more civilized places. Women at the fort continued an interest in London styles and wore imported dresses, shoes, hats and jewelry of the latest fashion. Books and magazines from London or Paris arrived within a year after publication so that when the fort's inhabitants gathered in each other's homes to drink tea or chocolate from their Chinese porcelain teacups, they could discuss recent news.

The inventory records and correspondence of John Askin, one of the fort's prominent merchants, reveals that he traded black and Indian slaves as well as furs and merchandise. Askin himself owned three black men and, at various times, a number of Indian slaves. He slept in a bed with curtains and had a billiard table and a library of several

hundred volumes. For transportation, Askin owned a caleche, a four-wheeled carriage with folding top, and even had a sedan chair in which his servants carried him around.

Fort Michilimackinac ended its historical career when its buildings and salvageable materials were moved to Mackinac Island. It was not until the 1850s that the next wave of settlers moved to the area from New England, following the logging operations in northern Michigan. They brought with them heavy, American-made "blue willow" dishes—coarse reminders of the beautiful translucent porcelain used by their predecessors in a transplanted English culture in the upper Great Lakes wilderness. ❁

About the author:

Eugene T. Petersen is director of historical restoration on Mackinac Island for the Mackinac Island State Park. He lives on the island year-round, and also directs the restorations at Fort Michilimackinac.

Visit to a modern Chinese porcelain factory

On a recent visit to the People's Republic of China sponsored by the American Association of Museums, my wife and I visited the Chenhsia porcelain factory at Changsha. Located in Hunan province, it is within a few hundred miles of the historic pottery site at Jingdezhen. The porcelain manufactured there today is similar to that found at Mackinac and of comparable quality, but scenes painted on the dishes no longer show human figures.

The factory employs hundreds of workers, and we were able to watch them perform the entire process of producing dinnerware, from pulverizing the traditional petuntse stone and kaolin clay (both are found nearby) to packing the finished products in hand-made wicker baskets. The machinery used to grind the stone and form the utensils is crude by American standards, but a vast improvement over 18th century methods.

At the same time, the art work is still done laboriously by young men and

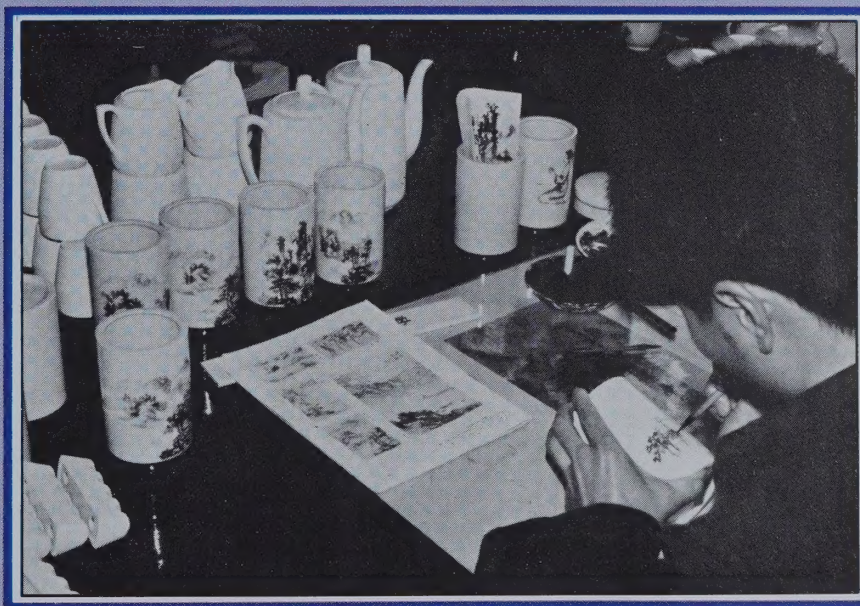
women working at ancient benches; they copy landscape scenes or other art with small brushes under poor lighting. In one section, the workers were turning out common kitchen cups and plates under the label "Crown Ming," which our guide said was destined for an Arab country.

Employees work six days a week with an hour for lunch and two 15-minute tea breaks. Motivated by competition to meet or exceed management production schedules, employees work in teams and

are paid an average of \$40 per month, with the most skilled workers receiving about \$60. This is about average for factory work in China today. A very high wage—in a tractor factory, for example—is \$60 to \$70 per month.

More than 90 per cent of the kitchenware and porcelain produced by the Chenhsia factory is exported, chiefly through Canton, as it has been since the 16th century.

—Eugene T. Petersen



In Praise of Archeology

The Sociobiology Game

**Archeology sheds light on whether our
behavior patterns are coded into our consciousness
by genes . . . or whether we learn them from the
institutions making up our cultures**

By W. L. Rathje

In the long-term biological view, humanity is essentially a relay team endlessly passing genetic material from generation to generation. What saves us from feeling bored and used, I believe, are the games we can play along the way: inventing agriculture, high fashion and Pac-Man . . . building civilizations and stumbling into their collapse . . . forming social classes and overthrowing them. But now some biologists are conspiring to take that fun away from us. They have created "sociobiology" to demonstrate not only that each generation carries forward genetic material, like Sisyphus his rock, but that this burden itself determines the way we fritter our lives away in our short turn on the genetic relay.

Nature or nurture? Are behavior patterns coded into our consciousness by genes, or do we learn them from the institutions making up our cultures? This question lies at the boundary between the biological and behavioral sciences, where, in a long-lived truce, all concerned tacitly agreed that genetic change—affecting such characteristics as our manual dexterity, ability to walk upright, and fundamental mental capacities (abetted by one or two learned cultural adaptations such as simple tool-making)—shaped us for our first few million years. Once our modern physical form was achieved, however, cultural change was accorded the primary role in human development. By this view, during the past 30,000 years we have acquired and discarded behaviors through cultural mechanisms—such as rules and laws, teachers and books, the school of

hard knocks, and even advertisements—not greatly affected by changes in our genetic make-up. Thus, genes determine mainly our physical characteristics, not our cultural behavior, in a traditional Darwinian perspective.

The truce has now been broken by the advocates of sociobiology, who give genes the paramount vote as determinants of our behavior—past and present. Thus, while in the conventional view behaviors such as altruism (selflessness) and garish displays of status symbols result largely from conscious decisions based on learned values, sociobiology sees the same behaviors as inborn, gene-based responses.

The discipline of sociobiology has been lauded by many. It has also been attacked: (1) as an idea that reinforces social bias (if genes control our behavior, then the *status quo* is justified as a reflection of inborn superiority and inferiority), (2) as an insult to humanity (there can be little free will if genes determine behavior), and (3) as simply wrong-headed.

Just about everyone has had something to say about sociobiology except archeologists. Yet, archeological studies are critical to evaluating sociobiology. To see how, we can compare the two mechanisms—genes versus culture—that are claimed to change behaviors.

Genetic change is slow, occurring when the percentage of people with a particular gene combination increases or decreases in a population. Such change proceeds when an environment "selects for" (somehow aids) people with certain genetically determined characteristics

(such as finger dexterity) to have more and more offspring, who in turn pass on their genes. Behavior changes in such cases are relentless, but gradual. Several generations must pass through selective pressures before a population can be really affected.

Non-genetic or cultural change can be much quicker. Because of millennia of genetic evolution, our brain is now an enormously subtle organ, endowed with both logic and memory, which permits the substitution of learning for genetic programming as the basis for behavior. Cultural change is merely the result of using our brains to switch our behavior patterns. It is different from genetic change—there is no lock at birth. If your hair is straight, you can curl it. If you are shy or cannot dance, you can attend Dale Carnegie, Arthur Murray or other how-to courses. Cultural changes—from fashions to politics—can occur, not in generations, but from one day to the next.

Slow change versus rapid change would seem to have clear implications. The making and use of stone tools evolved over millions of years and involved changes in our extremities, in hand-eye coordination, and in our ability to think abstractly. In this case, genetic changes were clearly crucial and slow. Compared to stone tool making, recent behavior/artifact innovations—farming, craft specialization, cities and space exploration programs—have appeared in the blink of an eye. Are these, also, largely the result of changes in gene frequencies? The central question concerning the validity of sociobiology, then, is

one of speed: *Just how fast can gene frequencies change?*

Quickly, according to sociobiologists, who have coined the "1,000-year rule": under the most favorable conditions, genetic alleles (different forms of a specific gene) favoring successful behaviors "can largely replace competing alleles within as few as 50 generations, or on the order of 1,000 years of human history." In other words, at best it takes a millennium for genetic changes to alter behaviors significantly.

Because of the long time spans they study, archeologists should have something to say about the 1,000-year rule. Take as an example 1,000 years of Lowland Maya civilization. During the first two centuries after Christ, scattered groups of farmers lumbered the Guatemalan rainforest to build small clusters of temples. Some of these minor ceremonial centers quickly turned major (most notably Tikal) and bustled into the Classic Period around A.D. 300 with spacious public plazas, burgeoning palaces and clumps of carved stone columns (called "stelae") proclaiming the glory of Maya rulers and displaying their haughty profiles.

Over the next 600 years, Classic Maya society grew into the most sophisticated civilization in the New World. For 200 of those years, the new Classic style seemed immutable in form as it spread from Guatemala as a full-blown ritual complex. Then for a short 50 years no commemorative stelae were carved in the Classic Maya heartland, and development seemed stalled. When it began again, the look of temples, palaces, stelae, glyphs and pottery differed from region to region, and style change in each proceeded apace.

Between A.D. 800 and 850, the gleaming temples which broached the jungle were abruptly abandoned to it. Thus, in one millennium, all manner of behaviors and styles came and went—from the farming techniques and plainware pots of everyday life to the priestly paraphernalia and temple facades of sacred ritual—and a whole civilization noisily arose and then fell silent.

This story of rapid revolutions in behavior is common in archeology. Southwest Indians moved from pithouses to

pueblos in most areas in 100 years or less. The farming lifeway crept from the Near East through the largest arable river valleys in Europe in a few centuries. The spread and contraction of each of the horizon styles of South America (Chavin-Cupisnique, Moche, Huari-Tiahuanaco, Inca) occurred in a matter of decades. Even the Indus civilization in Asia, famous for its stability, deteriorated during its later phases and lasted 500 years in total.

What does archeology say of the 1,000-year rule? That it is as mythical as Hitler's 1,000-year Reich.

As another example, archeologists might remind sociobiologists of a curious phenomenon concerning traditional hunter-gatherer possessions—or rather the lack of them. Material goods are heavy, so those who move frequently usually travel light. The archeological record all over the world shows that for

of frequent long moves, acquisitive behavior has popped out like a dancer from a cake.

Wouldn't it also follow, if cultural behaviors are heavily genetic at base, that those who were the product of generations of selection and predisposition toward a nomadic lifeway would be doomed to disaster in our high-tech society? I am reminded of a magazine photographer, traversing Australia's Great Western Desert, who thought he had found "natural man" in some naked aborigines, only to discover that they were "weekend abs" whose leader worked at a satellite tracking station.

Is this incongruous mix of behaviors really any surprise? It is an example of what cultural anthropologist Elman Service calls the Law of Evolutionary Potential. Simply stated, it is the story of the modernizing world. While it took thousands of years to evolve weapons,

many of the aforementioned !Kung, who were hired or shanghaied as mercenaries, have made the transition from stone knives to M-16 rifles—without changing their genes—in weeks or days.

Like all serious debates, the gene-culture controversy embodied in sociobiology will probably be reconciled by a compromise, one that assumes that our behavior is the outcome of both nature and nurture. The real question is one of degree. If sociobiologists are saying

that dancing, for example, is part of our genetic predisposition—our "human nature"—while specific dances are variations in learned cultural behavior, few will argue. When they claim much more—as they do—they are needlessly spoiling our cultural fun.

Nevertheless, I applaud their sociobiology because it invites us all to puzzle out just exactly what we are. Though, ultimately, we may be nothing more than a conduit through time for genetic materials, we can at least play some interesting cultural games—including sociobiology—along the way. ☸

W. L. Rathje is a Maya archeologist and director of the Garbage Project. He currently teaches at the University of Arizona in Tucson.



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"Your aptitude test indicates that you'd make a good hunter or gatherer."

thousands of years hunter-gatherers lived a highly mobile life which included few artifacts. Wouldn't sociobiologists expect that, after literally hundreds of generations of selection for travelling light, by now a genetic predisposition *against* collecting things would be in full swing?

Yet, though the !Kung San have been hunting and gathering (in the Kalahari region of southwest Africa) with a meager kit of tools for more than 1,000 years, today, when the !Kung settle down, they begin collecting goods like packrats. In fact, worldwide, most of the last hunter-gatherers now live in permanent settlements. Without the prospect

Opportunities in Archeology

Special Exhibits

New York: Stargods of the ancient Americas

A unique collection of art presenting the astronomical imagery of prehistoric Americans from the past 3,000 years is on display at the American Museum of Natural History in New York through March 27. Images of the sun, planets, moon and stars are seen in 140 artifacts in gold, turquoise, wood, stone and textiles. Organized by the Museum of the American Indian in New York, the exhibition demonstrates the role of astronomy, astrology and cosmology in cultures from the Arctic to the Argentine, with an emphasis on five major regions: the Plains Indians, the Southwestern Pueblo cultures, the central Mexican civilizations, the Maya and the Andean cultures. A photographic mural of the Great Maya observatory at Chichen Itza and photos of other natural observatories with explanatory labels are included in the exhibition.

Early peoples relied on observation of the sun and moon to help predict their hunting and growing seasons. Some cultures had sophisticated knowledge of astronomy as well—the Maya calendar, for example, was as precise as the Gregorian calendar we use today.

“Stargods” will later travel to Los Angeles and Boston and opens at the Adler Planetarium in Chicago on June 21—the summer solstice.



Made in the 16th century of painted wood with a serpent of gold, this jaguar drinking cup was used by the Colonial Inca during the ceremony of the December solstice to offer beer to the sun.

Photo: Museum of the American Indian

Detroit: 3,000 years of Costa Rican art

More than 300 artifacts from Costa Rica, including gold ornaments, jade pendants, elaborately carved stone sculptures and decorated ceramics, dating from 1500 B.C. to A.D. 1500, highlight a special exhibit in Detroit this winter. Organized by the Detroit Institute of Arts, this is the first comprehensive exhibit of Costa Rican art to tour the U.S. In Detroit from March 7 to May 22, the exhibit will go on to San Diego and Houston later this year.

Special Publications

Visitor's guide to Mesoamerican ruins

Anyone travelling south of the border this winter will find *The Complete Visitor's Guide to Mesoamerican Ruins* by Joyce Kelly an informative and useful reference. Amply illustrated with photographs, drawings and ground plans of ruins, the book is a guide to major archeological sites and museums in Mexico, Guatemala, Belize, Honduras and El Salvador. Each site is described along with an account of its recent history and di-

rections on how to get there.

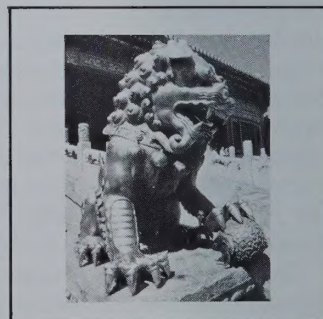
The guide is available through the University of Oklahoma Press, Norman, OK 73019. Price: \$35.

Tours

The archeology of China

The Peabody Museum of Harvard University is offering an exciting three-week archeological tour of China this spring led by Kwang-Chih Chang, a specialist in Chinese archeology and chairman of the anthropology department at Harvard. Starting with the Forbidden City in Beijing, the tour will go west along the Silk Route travelled by Marco Polo to see the caves of the Thousand Buddhas in Dunhuang and the centuries-old caravan oasis of Urumqi. Xian in central China, where the first Chinese emperor and builder of the Great Wall was buried along with an army of over 7,000 life-size terra cotta figures, will also be visited. The tour ends in eastern China, stopping in Shanghai and Suzhou, known as the Venice of China.

Contact: Travel Dynamics, Inc., 1290 Avenue of the Americas, New York, N.Y. 10104.



Field Work

In her new book, Dr. Joyce Brothers recommends several things to women who want to meet men: take a cross-country skiing weekend, buy a dog and walk him frequently, sign up as a volunteer on an archeological dig. Whether or not you heed Dr. Brothers' advice, there are plenty of opportunities to participate in archeology in 1983:

Help record ancient rock art in New Mexico

Working primarily in the Gila National Forest of west-central New Mexico, the Archeological Society of New Mexico is offering a rock art recording field school for 30 people this summer. The area is a transition zone for the Anasazi and Mogollon cultures, with an estimated 10,000 to 12,000 archeological sites. As part of the statewide survey of rock art begun 12 years ago, the field school uses photography and forms to record rock art in this little explored archeological area.

Operating from June 11-25, the field school is strictly a camping situation, with participants furnishing their own food, tents and cameras. Film is provided by the field school, which charges \$50 a week for an individual or \$75 for two weeks, with reduced rates for families.

Contact: Col. James G. Bain, 1111 Jefferson St., N.E., Albuquerque, N.M. 87110, (505) 255-4486.

Explore cave sites in Kentucky

For an unusual experience, the Summer University at Mammoth Cave is offering courses in archeology, geology and geomorphology, cave ecology and hydrology. The courses are open for university credit or on an audit basis.

Running from June 5-11 with two additional weeks of independent research, the course in cave archeology is taught by Patty Jo Watson of Washington University. The course includes morning lectures with afternoons spent surveying caves. Occupational sites dating from 2,000 to 4,000 years ago have been found in rock shelters in the region, and deep caves were mined for minerals, such as gypsum.

Campgrounds at Mammoth

Cave are available for field school participants, but motels are nearby as well. To register, contact: Dr. Nicholas Crawford, Center for Cave & Karst Studies, Dept. of Geography & Geology, Western Kentucky University, Bowling Green, KY 42101.

Volunteers needed in Maryland

Volunteers are invited to assist the Maryland Geological Survey in its contract archeology program this summer. The Survey will also be excavating a Late Woodland/Early Historic site on the eastern Maryland shore, dating to around A.D. 1600, for a 10-day field school in late May.

For further information write: Dennis Curry, Division of Archeology, Maryland

Geological Survey, Johns Hopkins University, Baltimore, MD 21218.

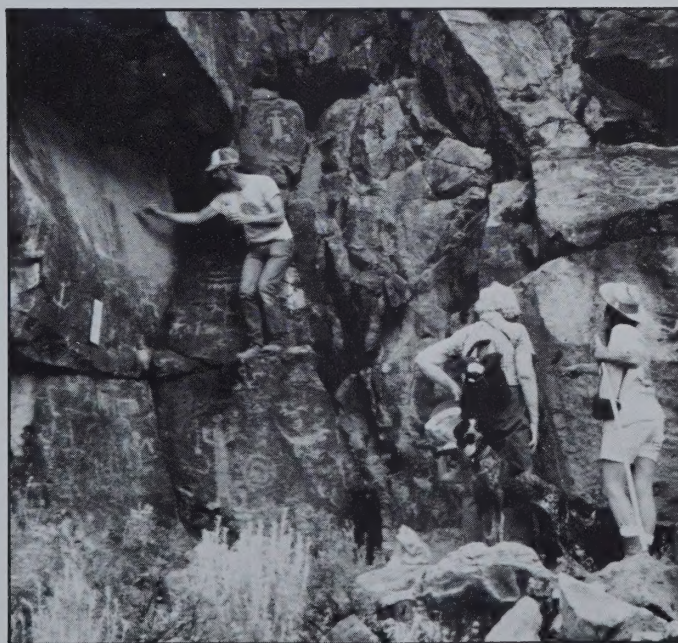
Southwest Colorado: Crow Canyon Campus

The Center for American Archeology, best known for its teaching and research facilities in Kampsville, Illinois, is opening a Southwest campus this spring in Cortez, Colorado. Located just 10 miles from Mesa Verde National Park, the Crow Canyon Campus offers one-week field school programs from May through November for junior high and high school students.

Sessions for adult associates of the Center are available in August and September to rescue archeological sites that face imminent destruction. Other research expeditions for adults throughout the summer include projects in archaeoastronomy, rock art of the Desert Bighorn and San Juan River, native American technology, and excavation and exploration of Anasazi sites in the Four Corners region.

Two special workshops are also offered: a teachers' workshop in archeological techniques and southwestern prehistory, and an outdoor instructors' workshop to train in methods of utilizing archeological sites in outdoor education.

For more information write: CAA, 1911 Ridge Ave., Evanston, IL 60201. Telephone: (312) 492-5300.



A rock art recording team working at a site along the Tularosa River near Reserve, New Mexico.

Speaking Out

Caribbean shipwrecks: Sharks are the least of the problems facing underwater archeology in this one-time arena of European powers

By Sumner Gerard

Compared to shipwreck work accomplished in other parts of the world, nautical archeology in the Western Hemisphere is in its infancy, having existed as an archeological sub-discipline for little more than a decade. In contrast, the excavation of submerged cultural remains developed much earlier in the Mediterranean as an outgrowth of archeological work long under way there by people trained in classical archeology. Early on, underwater research in Europe also benefited from political encouragement, sources of support and access to sites. European sponge fishermen were prime sources of site information, eliminating the need for complicated and costly electronic surveys of the sea bottom. Generally, the American sponge fisherman was not a wreck locator. Furthermore, scuba and other gear required for proper underwater excavation was originally developed in Europe, only later reaching this hemisphere.

In Europe, the archeologist put on his air tank and jumped into the water where the fisherman or sponge diver took him, developing a simple but careful methodology as he went along, and applying land standards of archeological investigation to the marine environment as much as possible—without having to worry about sharks. His sunken targets also were often of great antiquity with no existent historical records applying to them, so that each wreck became a special puzzle requiring extensive knowledge of art, metallurgy, history and ceramic forms—as well as considerable intuition—to determine a wreck's origin, nationality, date and other significant details. With this information in hand, studies of trade routes and sailing

methods, ship construction, diffusion of art styles, and human migrations and colonization could be undertaken.

New World underwater research has its own special considerations and obstacles to overcome. Most significantly, it has concentrated thus far mostly on evidences of the sudden arrival in the Americas of European cultures which imposed a highly-varied patchwork of social institutions, languages and ethnic variations—many of which continue to this day—wherever they went.

Ships of older civilizations may yet be found, but for now, underwater studies in the Americas concern themselves largely with European and colonial ships. The overwhelming concentration of potential underwater excavations of major historic interest lie in the Caribbean, the earliest area of significant alien impact—and *this sea has unique characteristics.*

Though often superficially compared to the Mediterranean as an enclosed sea, the Caribbean's complex geography, oceanography and staccato history set it apart. The great arc of its windward islands acted as barriers and bastions, reinforced by the Bahamas to the north, guarding access to the mainlands on the south and west. Unlike the Mediterranean, which has linked the people on its coasts for millennia and was comparatively benign and easily navigable, the Caribbean is a savage and unforgiving sea, studded with hundreds of small islands fringed by dangerous coral reefs and repeatedly ravaged by fierce hurricanes and calamitous earthquakes.

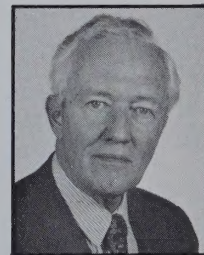
Moreover, its whole violent history has been unrelentingly dictated by the strong northeast trade winds and westerly-setting currents culminating in the

Gulf Stream to the north. Appealing and romantic though its shores may be, and as clear and inviting as its waters are at many times of the year, disease ashore and disaster afloat have made it the graveyard of thousands of ships and many more thousands of men.

For well over 300 years, the Caribbean was the arena of contending European powers entirely dependent on relatively inefficient sailing vessels for their military, commercial, and, in large measure, political survival. The West Indies were easy to reach on the prevailing easterly trade winds, but a good deal more difficult to leave, as hundreds of successive fleets of Spaniards, Portuguese, Englishmen, Frenchmen, Dutchmen, Swedes, Danes, Americans and others found out. Because of the un-

(Continued on page 45)

Sumner Gerard, a director of the Institute of Nautical Archeology (INA) based at Texas A & M University, was U.S. ambassador to Jamaica, 1974-1977, and prior to that for several years, director of the Agency for International Development in Tunisia.



Currently operating a research vessel based at Miami, Gerard has played an important role in establishing a long-term, underwater archeological research program at Port Royal, Jamaica. The Port Royal Project, a joint venture of the INA and the Jamaican government, operates one of the few field research stations in the world providing sustained opportunities for training in nautical archeology.

Issues in Archeology

Getting Off the Gold Standard

The science of "wreckology" can answer important questions about human behavior—then and now

By Richard A. Gould

My introduction to underwater archeology came in a pub just off Downing Street in Cambridge, England, in 1977, where I met regularly with the late Keith Muckelroy and had searching discussions with him about shipwrecks and their scholarly value. Keith was about to publish his book, *Maritime Archeology*, and I asked him what an anthropologist or an anthropologically-oriented archeologist could expect to learn from studying shipwrecks and wreck-related materials. Much of what I say today began to take shape under the influence of Keith's ideas.

Two inseparable issues stand out in shipwreck archeology today. One is the public's (and the media's) virtual obsession with treasure-hunting and relic-collecting. For many people, this *is* shipwreck archeology. The other is the question of whether shipwreck archeology can be usefully regarded as a part of social science, and if so, how. These issues are inseparable because an anthropologist cannot "buy in" to this field without deciding upon what currency to value his or her efforts.

A newcomer is immediately confronted by several paradoxes. Books with titles like *Gold, Galleons and Archeology* and *Treasures of the Armada* compete for attention with more unmistakably scholarly productions. Often, books of the former kind bulge with illustrations of coins and ingots, to the point where one's eyeballs start to glaze from the repetition of seeing gold and silver objects page after page. The apparently endless stream of articles in magazines like *National Geographic* and television shows like those aired not long ago on *60 Minutes* and *PM Magazine* have the same numbing effect. Seeing all this stuff, one has to ask: What kind of archeology is this anyway?

On a more professional level, there is the inescapable irony of a field that effectively applies the most sophisticated technology available in archeology today to an extremely limited set of scholarly goals. I am something of a technological "junkie" myself, and I think it's great that we can use mini-submarines, side-scanning sonar and

other hi-tech items in our studies. But there may be confusion here of means with ends. The use of scientific techniques, no matter how advanced, does not necessarily mean that we are doing scientific research in any sense of the word. We should give thought to social scientific goals that are consistent with the kinds of information that can come from shipwreck studies. Perhaps anthropology can make a contribution in this regard.

Of course, there are exceptions to these gross generalizations, and I can see many possible models within the field for developing a more coherent and less schizophrenic approach to the archeology of shipwrecks. Fortunately, questioning and debate are occurring within the field, signs that shipwreck archeology will not deteriorate into mere intellectual stamp-collecting. It is clear that scholarly standards are replacing the gold standard in shipwreck archeology, and I want to cheer that process on.

Digging for gold: the archeologist's response

Looting existed long before archeology. One has only to read the accounts of early land buccaneers like Giovanni Belzoni in Egypt in the early 19th century to appreciate the stigma that affected much of this emerging discipline's efforts to gain legitimacy. In 1817, Belzoni robbed the tombs at Thebes and described his efforts:

Richard A. Gould, professor of anthropology at Brown University, Providence, Rhode Island, delivered these remarks as keynote speaker for the Conference on Underwater Archeology held in Denver, January, 1983.

"... every step I took I crushed a mummy in some part or other. When my weight bore on the body of an Egyptian, it crushed like a band-box. I sank altogether among the broken mummies with a crash of bones, rags and wooden cases. I could not avoid being covered with bones, legs, arms and heads rolling from above."

To many people then, this was archeology. Scholarly archeologists of that day were outraged, not so much by Belzoni's destructive practices as by the fact that his primary goal was to sell the objects he found. Glyn Daniel notes that the rivalry between excavators in the Near East then in their search for antiquities was nothing short of piracy, made no better for the fact that it was often done on behalf of the British Museum or the Louvre, as well as private dealers and collectors. Yet he also notes that Belzoni's efforts were widely praised at that time and later with the argument that, had it not been for his efforts, we would not be aware of these treasures today or be able to see them displayed.

So there is nothing new in what we see today in comparable efforts underwater by private individuals and corporations in places like Florida and the Texas Gulf coast. But what makes today's practices especially insidious is the way well-trained archeologists and historians have been co-opted into these efforts in order to provide a veneer of legitimacy to this activity. We are told that treasure-hunting is all right because now it is being done carefully!

I realize that there are serious questions about whether that claim is true or not, but the main point is not whether it is being done carefully, but that it is being done for personal or corporate gain. This violates what I shall call the First Law of Land Archeology, which is that, "Thou shalt not keep (or sell) thy goodies." This principle has long been accepted in land archeology and is embodied in ethical and professional statements of organizations like the Society for American Archeology and the Society for Professional Archeology, to name only two.

This position is further supported by state and federal legislation that makes it illegal for anyone to loot archeological sites on federal or state lands. However difficult these laws are to enforce, they make it clear that land archeologists now operate on this principle. My argument is simply that the same principle should operate under water.

And why shouldn't it? Archeological materials resting under water are as much a part of America's cultural heritage as remains occurring in sites on land. Out-of-date legislation pertaining to underwater salvage will need to be revised to represent the public interest inherent in *all* antiquities, whether underwater or on land, and these laws will have to recognize the existence of scientific archeology as a means of preserving the cultural record. Archeologists will have to agree on uniform standards of excavation, preservation and access to excavated materials that apply to both land and underwater research. The archeological profession will have to seek out ways to inform people generally that such a cultural heritage exists as public trust and not as the private preserve of treasure-hunters. The mutuality of interest between land and underwater archeology is close and needs to be emphasized in spite of obvious differences, like the way one archeologist wears cowboy boots while the other wears fins.

Shipwrecks as anthropology

Earlier, I suggested that there may be larger goals for shipwreck archeologists to consider than those widely pursued in the field today. This is not a doctrinaire assertion that "shipwreck archeology is anthropology or it is nothing." There is nothing wrong with scholars maintaining their interests in reconstruction of nautical technology or in addressing specific questions of historical interest like the Bronze Age copper trade in the eastern Mediterranean. Indeed, detailed studies are needed in all aspects of the ancient technology of maritime activity before anthropological hypotheses about human nautical behavior can be tested effectively.

However, there is a need within the field to develop general hypotheses about human behavior in relation to shipwreck materials and to set about testing them. To some outside observers and members of the lay public, shipwreck archeology looks like nothing more than the study of nautical trivia—a kind of antiquarianism that holds little appeal beyond the obvious element of adventure involved in underwater work generally and romanticism of the historic associations of the relics thus obtained. Adventure and romanticism are not enough, however, if shipwreck archeologists are ever going to convince people generally that this research may be important to them both as part of their cultural heritage and as members of the human species.

The key to developing testable hypotheses about human behavior in relation to materials and material remains such as wrecks is to establish a reliable basis of inference based on observations of present-day human behavior. If our generalizations are based on scientifically acceptable assumptions that can be expected to hold true for both past and present human behavior, then we have a basis for such inferences.

Rather than go on about this in the abstract, let's look briefly at two examples of such generalizations and how they can be tested in ways that can inform and enliven the field of shipwreck archeology.

The wreckage of commerce

When the *Trinidad Valencera* was wrecked on the north coast of Ireland in 1588 during the flight of the Spanish Armada, it contained a rich array of weapons and equipment of the period. These materials have received much publicity as archeological work has proceeded on the wreck, but public attention given to this wreck should not be allowed to overshadow its more mundane but anthropologically interesting features.

Colin Martin, who has analyzed and reported on this wreck, noted that the *Trinidad Valencera* was a 16th century Venetian merchantman requisitioned by Philip II originally to ransack European ports under Spanish con-

trol, in order to prepare for his "Enterprise of England." Looking closely at the construction details of this wreck, Martin pointed out that the ship's timbers were fastened by means of iron fittings, which were arranged in regular patterns along the wood grain of the ship's planks. He interprets these details as evidence of mass-production by 16th century Venetian shipbuilders, since iron fittings could be fabricated more quickly and by more unskilled workers than would be the case for wooden pegs inserted into drilled holes. Similarly, the linear arrangement of these fittings was quicker and easier to install than fittings arranged to counteract weaknesses in the wood grain. In each of these patterns we see an aspect of behavior that was geared to cheap and fast production, rather than longevity.

We need to keep in mind that while the *Trinidad Valencera's* contents and cargo had mainly to do with the logistics of war, its construction was dictated by the demands of commerce. Do the contents of this wreck afford an opportunity to identify larger relationships between maritime commerce generally and the wreckage produced by such commercial activities? Martin's argument is fine as far as it goes, and his analysis of this and other wrecks amply demonstrates the value of careful historical scholarship in relation to wreck materials. But there is also an anthropological dimension to this wreck that can be usefully examined.

To explore this idea, let's consider the case of modern supertankers. As Noel Mostert points out in his book, *Supership*, such vessels are also constructed with initial economy in mind. All-welded hulls and single-screw propulsion are only two of the more obvious features of the supertanker, and it is Mostert's argument that such economies in the interest of mass-production, at a time when the worldwide demand for oil transported by tankers was at a peak during the closing of the Suez Canal, posed major safety and environmental hazards due to the vulnerability of these ships to storms, errors in navigation, and fire.

It would seem that in the supertanker of today we have a modern analogue to the Venetian merchantman of the 16th century. In each case, use-lives of these ships were expected to be short but profitable, and they were constructed accordingly.

But is there a general principle that unites these different historic examples and lifts them out of the realm of interesting coincidences? If we accept the assumption that each case is structured by a form of capitalistic commerce, we can further argue that each is a potential example of what Larry Murphy has aptly called the "One More Voyage Hypothesis." In essence, this hypothesis asserts that the desire for commercial profit will result in ships being pushed by their owners beyond their designed use-lives, with the expectation that if they last "just one more voyage," the profits will outweigh the loss that inevitably results when a vital part of the ship's structure fails in a storm or some similar circumstance.

This, of course, is what "flags of convenience" are all about today, and Mostert eloquently points out the deep-seated cynicism that underlies such attempts to legally circumvent regulations that would otherwise inhibit the overextended use of such ships. No wonder so many supertankers today operate under foreign flags of convenience. And no wonder they are so dangerous.

What are some of the test implications of this hypothesis? Murphy has proposed a test for the wrecks of Great Lakes steamers of the 19th and early 20th century. Because the Great Lakes are bodies of fresh water and since corrosion is less of a destructive factor than in salt water, we would expect ships' machinery to wear out before the ships' hulls. Great Lakes geography abounds in natural hazards to shipping—one of the worst of these is Isle Royale. The presumption is that failures of machinery such as engines or steering gear during storms led to unusual concentrations of wrecks in locations like Isle Royale, and these failures can be attributed to the "one more voyage" behavior cited earlier. By diving on wrecked steamers in the Isle Royale area, archeologists can test this hypothesis through examination of each wreck to see what it was that failed when the ship went down. Hull failures would, in this case, effectively disprove the hypothesis, since, if the hypothesis is correct, one would expect to find evidence of machinery failures instead.

Such systematic testing of the hypothesized relationships between commercial behavior and maritime residues cannot help but produce worthwhile results, since the question of what it was that failed when these ships went down can now be viewed within a larger, social scientific context that has worldwide implications. From a practical point of view, such a test does not require total excavation of each wreck, which of course would be financially and logistically impractical. Nor does it restrict our potential universe of wrecks to study, since any commercial wreck from any period in world history from the Bronze Age onward is eligible for testing. What we have here, in short, is the basis of a possible archeological "signature" of the profit motive in maritime commerce.

The wreckage of war

If we turn once again to the Spanish Armada, we can set forth hypotheses having to do with how certain archeological patterns can serve as "signatures" of particular kinds of behavior by combatants during war. Again, we have an apparent modern analogue in the form of the Battle of Britain in 1940. Although a span of 352 years separates these two historic episodes, they present us with many specific parallels. Historians have emphasized particular tactics and personalities, regarding parallel situations as coincidences involving essentially unique events. Wrecks abound from both the Armada and the Battle of Britain, and many of these have been studied under controlled conditions.

Each of these battles was a protracted engagement involving the prospect of invasion of England by what was then the most powerful and consistently successful land army in Europe. In each case, the conflict continued afterwards with equal or greater ferocity. Each episode involved innovative tactics and represented a clear break with earlier traditions of warfare.

Archeological analysis of Armada wrecks has centered on three specific historic issues: (1) The competence of

the Duke of Medina Sidonia, Philip II's choice as the leader of the *Enterprise* after the death of the Marquis of Santa Cruz. (2) Construction differences between English and Spanish fighting ships. (3) The relative qualities of guns and gunnery among the combatants, with special attention to problems that the Spanish had with their cannonballs. In each of these issues, shipwreck archeology has or can make a definitive contribution.

Martin's study of the wreck of *El Gran Grifon* revealed evidence of a rational distribution of guns to a second-line fighting ship, demonstrating that the Duke of Medina Sidonia had done exactly what Philip II had expected of him, namely to sort out the confusion following Santa Cruz' death and organize the men and equipment of the Armada. Analysis of construction details of the *Santa Maria de la Rosa* by Martin showed further that the Spanish ships were of Mediterranean design, with most of the hull strength concentrated in the inter-locking of many close-fitting components to form a self-stressing shell.

"Atlantic" ships, like Elizabeth's galleons, derived their strength from an internally stressed frame of fewer but more massive components. Historic accounts and archeology both show that the *Santa Maria* was overstrained by her mast, which could give way in high winds or heavy seas, explaining the rapidity with which she sank. Such were the ships that fought and failed.

Finally, Sidney Wignall noted that in over 30 years of face-to-face gunnery battles during this period, Spanish heavy cannon had failed to sink a single English galleon, even when shooting at point-blank range. Cannonballs recovered from the wreck of *El Gran Grifon* and the *Santa Maria* were sectioned and found to contain masses of concentric rings, indicating quenching after casting—a process that would make the balls brittle. Wignall argues that the astonishingly poor results of Spanish gunnery were due to these cannonballs bursting upon impact against the sides of English ships. Further archeological testing of this idea could resolve the "cannonball controversy" surrounding 16th century Spanish gunnery.

From these debates we can draw two general conclusions about the current state of the art in shipwreck archeology in relation to warfare: (1) Circumstantial evidence provided by archeology can decisively settle historical debates that might otherwise go on without end. (2) While wrecks tell us little about particular tactics, they are informative at the level of logistics and help explain the nature of preparations for war. But the question remains: Can shipwreck archeology venture effectively beyond the explanation of particular historical events?

As an island nation, England was under siege-like conditions both in 1588 and in 1940. England's access to raw materials and manufactured goods was most restricted when these were most needed. Because they were on the defensive, the English made extraordinary efforts to husband their resources as part of their overall preparation for battle. England's defensive isolation is revealed not only by the rhetoric of the leaders at that time but also by organized efforts to obtain and recycle both weapons and strategic raw materials for immediate use.

In both cases, the most characteristic response, noted only in passing by historians, is what I call "defensive recycling." It consists of urgent salvaging of weapons and/or strategic materials by the combatants on the defensive for

immediate reuse during a period of perceived crisis. True recycling occurs when the component materials of the archeological discard are transformed into new products that may not resemble the original item at all. One may also regard reuse as a form of recycling, especially when one sees transference of the item from one user to the other. Both kinds of recycling characterize defensive behavior of the English during and immediately after each of these military episodes.

Following word that Armada ships were being wrecked on the west coast of Ireland, Lord Deputy Fitzwilliam, acting for Elizabeth, commissioned Sir George Carew as Minister for Ordnance on September 22, 1588, to go to Ireland and salvage any cannons and ammunition he could get. From March through August, 1589, Carew used divers off a Navy ship, the *Popinjay*, to recover bronze cannons, and his efforts were matched by others in the Channel on the Dutch coast. Lest anyone doubt the urgency of this commission, it concluded with the phrase: "Torture may be used in prosecuting this inquiry."

Similar arrangements existed in 1940, although emphasis then was on strategic materials—mainly aluminum. Wrecked German aircraft were brought to the dumps in England, where parts were recovered and sorted by eight salvage units of the Civilian Repair Organization, formed originally by Lord Nuffield in 1938 following the Munich crisis. Alloys were melted down and reused in RAF aircraft. Under Beaverbrook in 1940, the CRO managed to increase its output from 20 repaired aircraft per week in February to 160 per week by mid-July. Photographs of these dumps exist, although the actual extent to which German alloys were reused in English aircraft remains to be determined.

What we have, then, is an hypothesis which can be posited more generally and tested cross-culturally: The greater the defensive isolation of a combatant, the greater will be the efforts of that combatant to salvage and recycle items and/or materials of strategic value from any wrecks that fall within their territory. If one accepts this argument at least provisionally, then it follows that wreck archeologists should look next for evidence of Spanish guns in contemporaneous English ships and land fortifications, or the use of German alloys or parts in English aircraft from the Battle of Britain. Such tests can tell us how far to go in regarding recycling as the archeological "signature" of defensive stress.

Conclusion

Looking at these examples from the wreckage of commerce and war, I am suggesting that the anthropological approach to shipwrecks consists of a search for general, circumstantial relationships between materials and human behavior that apply equally to present and past processes by which wrecks form and come to rest where they do.

However, no such science as "wreckology" is possible if both land and underwater archeologists do not utterly repudiate the gold standard and concentrate instead on the scholarly standards of historical and social science.

and recast into new items. If any fragments of bronze were found, they were only the small pieces lost by their owners. And objects from hoards and graves—axes, sickles, knives, hammers, anvils, files, swords, and jewelry—rarely appear in settlement debris. At Hascherkeller only a few small objects have been found. A complete bronze pin measuring 8.2 centimeters in length and a complete bronze ring 1.4 centimeters in diameter have been recovered along with many fragments of pins and other scrap bronze. Particularly interesting is a sandstone mold used to cast bronze finger rings. Its presence indicates that the inhabitants cast their own jewelry and did not rely on trade for all their finished bronze goods. The metal itself had to be imported from other areas since no copper or tin ores occur in the vicinity. Many small Bronze Age communities had one individual who was versed in the techniques of casting bronze and who satisfied the village's need for metal objects.

Archaeologists have recovered three fragments of iron slag and five small fragmentary iron objects, all so badly corroded that their original forms are unclear. The presence of slag indicates that iron, the ore of which occurs all over central Europe, was worked at Hascherkeller. Since the radiocarbon dates suggest that the site was occupied between 1000 and 800 B.C., this iron is relatively early. Most central European sites where evidence of iron production has been found date to sometime after 750 B.C.

Ceramic loom weights and spindle whorls found at the site, together with the faunal evidence that sheep were kept for wool, point to the existence of an active textile industry at Hascherkeller. Unfortunately, no textiles have survived because of the bad conditions for the preservation of organic substances, but finds from more favorable environments indicate a high level of development in the weaving of woolen and linen garments. Woolen cloth may have been manufactured at Hascherkeller for trade to other communities in exchange for other materials.

Bone and antler were carved into a variety of useful objects at the settlement. Excavations have recovered antlers of red deer, some with parts cut off to be used as raw material and others prepared to serve as picks. Bone and antler were used for such items as buttons, ornaments and handles for knives and awls. No stone occurs naturally at or near the settlement, since the soil is a fine-grained loess, yet stone played a substantial role at Hascherkeller. In addition to the sandstone mold, pebbles collected from the banks of the Isar served as hammers, grinders and slingstones.

The copper at Hascherkeller came from mines in the Tirol region of Austria, 120 kilometers to the south. The source of tin is unclear, but it may have come from the Erzgebirge of East Germany or from sources even more distant. Graphite, used to decorate pottery, was mined and traded on a large scale at this time. Many sherds at Hascherkeller have graphite applied to the outer surfaces to provide a lustrous black color. The principal sources of graphite in central Europe are east of Passau along the Danube, about 100 kilometers east of Hascherkeller. Dark blue glass beads were imported and were probably

worn on necklaces and bracelets. They are thought to have been manufactured in the Tirol in an industry associated with the smelting of copper ores. The substantial amount of bronze scrap and the large numbers of sherds coated with graphite at Hascherkeller indicate the strength and productivity of commercial interactions between this small community and others.

Hascherkeller was probably a fairly typical central European community of the Late Bronze Age in terms of its size, subsistence economy, and manufacturing and trade activities. The people were well adapted to their local environment, and were making strong efforts to exploit their environment efficiently and to utilize the plants and animals they raised. Manufacture of pottery and metal objects most likely was done by individuals who spent most of their time farming and who learned their skills from specialists. None of the artisans in a community the size of Hascherkeller were full-time specialists. The level of technical expertise apparent in the pottery and sandstone casting does not speak of the work of a full-time specialist as do, for example, some of the bronze vessels and helmets made in the middle Danube region of eastern Europe at this time.

Hascherkeller was but one of many Late Bronze Age settlements in central Europe, all more or less equal in size, wealth and status. Communities similar to Hascherkeller, inhabited by farmers and craftspeople, still exist today in many parts of Europe. They differ from their prehistoric counterparts not so much in the way of life as in their degree of independence. After 600 B.C., centers of manufacturing, trade, wealth, and power began to develop, and the smaller communities became more and more tied to the growing economic and political hierarchies. The substantial degree of autonomy, economic self-sufficiency and small-scale community life we see at Hascherkeller are the essential features of central European society a thousand years before the birth of Christ.

FOR FURTHER READING on the Late Bronze Age: J.M. Coles and A.F. Harding, *The Bronze Age in Europe* (St. Martin's Press, New York 1979); H.G.H. Härke, *Settlement Types and Patterns in the West Hallstatt Province* (British Archaeological Reports, Oxford, England 1979), discusses particular settlements; P.S. Wells, *Culture Contact and Culture Change: Early Iron Age Central Europe and the Mediterranean World* (Cambridge University Press, New York 1980), discusses the cultural changes after 600 B.C. which led to the development of larger communities and more complex economic systems, and *Rural Economy in the Early Iron Age: Excavations at Hascherkeller 1978-1981* (Peabody Museum, Harvard University, in press), presents the full results of the first four seasons of fieldwork; preliminary reports on the excavations at Hascherkeller have appeared in the *Journal of Field Archaeology* 6 (1979): 17-28; 7 (1980): 313-28; 8 (1981): 289-302.

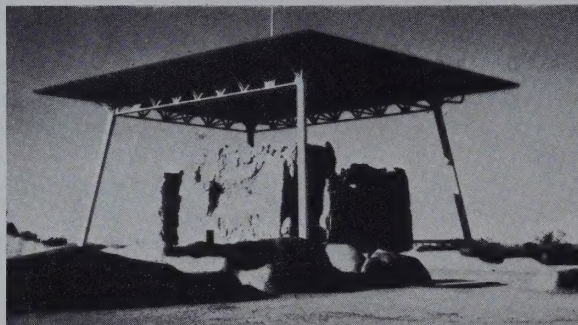
On the Threshold of Civilization: The Hohokam of Arizona

On June 26, 1694, Lieutenant Juan Matheo Manje returned to one of the northern outposts of New Spain at Caborca, Sonora, having completed a journey of exploration through what later became the Papago Indian Reservation of southwestern Arizona. Feverish from drinking brackish water, he recounted a story he had heard of a large river to the north lined with "casas grandes," or tall houses with thick walls. His superior, Father Eusebio Francisco Kino, received this tale skeptically until Pima Indians from the village of Bac, near modern Tucson, confirmed Manje's account and offered to guide the padre to these mysterious homes.

Kino traveled inland as far north as the Gila River where, in November 1694, he encountered a four-story great house "as large as a castle and equal to the largest church in Sonora." The building, known today as Casa Grande, had been abandoned but was still in good condition, needing only roof repairs to make it habitable. The native Pima Indians held the structure in awe, depositing precious feathers, arrows, gourds, and other valuables in one of the rooms. Nearby, Kino observed the ruins of many other smaller houses surrounding the Casa Grande and a large canal with banks more than 5.5 meters wide. The padre also heard of seven or eight other great houses and the remains of entire cities to the north, west and east. The ruins of the Classic Hohokam Indians had been discovered.

Since the time of Kino, explorers and, somewhat later, archaeologists have attempted to understand the nature of the society responsible for the Casa Grande. Working between 1885 and 1910, Frank Hamilton Cushing and Jesse Walter Fewkes, the first archaeologists to study the Hohokam, wedded their excavated data to Pima and other Indian legends. In their view, great chiefs or lords resided in palatial structures and dominated a large peasantry in an ancient feudal society. Surveys and excavations in the late 1920s and 1930s conducted by Harold S. Gladwin, Erich Schmidt and Emil W. Haury disclosed a long archaeological sequence leading up to the Classic period. The Hohokam Classic period (ca. A.D. 1150-1450) is characterized by adobe compounds that enclose rectangular rooms and plazas, platform mounds, extensive irrigation canals, and polychrome and polished redware ceramics. During the Classic, hundreds of agricultural villages consisting of from one to

by **RANDALL H. MCGUIRE**
and **MICHAEL B. SCHIFFER**



The ruin of the Casa Grande as it appears today after stabilization and construction of a protective roof by the National Park Service.

over 100 compounds each dotted the Gila and Lower Salt Rivers of central Arizona.

For the next several decades, however, research focused on the earlier Hohokam periods, and the Classic was virtually ignored. Beginning in the late 1960s and 1970s, fieldwork carried out in advance of proposed dams, mines, highways, and other projects led to renewed interest in the enigmatic constructions discovered by Padre Kino. Ironically, what has emerged is a picture of

Classic society not unlike the one sketched by the pioneer archaeologists nearly a century ago. Today archaeologists are analyzing the rise and fall of the Hohokam to understand the development of complex societies around the globe. Although the Hohokam may seem less significant compared to most archaeological sequences in world prehistory—the great civilizations that rose in places like Egypt, Peru, Mesoamerica, and Mesopotamia—their emergence and collapse especially fascinates students of cultural evolution because they almost reached civilization. Many factors that figure in the rise of civilization, including irrigation agriculture, social stratification, and a relatively high population density, were present in Arizona. But they did not give birth to a Hohokam civilization.

The first archaeologists to excavate Classic period Hohokam sites took to the field in the late 1800s and early 1900s. Cushing worked near present-day Phoenix on what was the first archaeological excavation in Arizona. He excavated several ruins during the winters of 1886-88, concentrating his efforts on Los Muertos—probably the largest Classic Hohokam site. In the winters of 1906-8, Fewkes dug extensively in the great house itself and nearby ruins in the Casa Grande National Monument. The investigations of Cushing and Fewkes revealed large habitation compounds, canals, cremations and burials, pottery and other domestic artifacts of the Classic period and, at Los Muertos, the poorly preserved remnants of another great house. The fieldwork also exposed the remains of more ephemeral structures, known today simply as pithouses—small, oval structures dug partially into the desert soil and probably roofed with brush and mud—not unlike aboriginal Pima houses.

Cushing and Fewkes drew on their intimate knowledge of living southwestern tribes, and particularly on Pima legends, to formulate their reconstructions of Classic Hohokam society. Today the Pima refer to the Casa Grande and other



Artisans of the Hohokam Classic period produced many fine examples of shell work. These mosaics, discovered at the Casa Grande, were formed by glueing bits of turquoise to marine shells. Length of lower mosaic, 11 centimeters.





Gila Polychrome was the most common painted pottery during the Hohokam Classic period. Most pieces, such as this bowl, were probably manufactured in the Roosevelt Lake area and traded to the Hohokam. Diameter, 24 centimeters.

large ruins of the Gila and Salt Rivers as “va-aki,” or magic houses, each erected by a magic chief or “si-vane.” A man named Bitterman si-vane is credited with building the Casa Grande. Legends also recount the triumphs of a great leader, Elder Brother, who led the Pima against the oppressive si-vane and their followers. Elder Brother and his forces first attacked the Casa Grande, then home of Morning-blue si-vane, and destroyed it. From there the victorious army moved along the Salt and Gila rivers attacking each lesser va-aki, one by one, destroying them and killing their resident chiefs.

Told repeatedly and with great conviction by the Pima, such stories furnished Cushing and Fewkes with ready-made interpretations for the impressive ruins. The large adobe compounds obviously were the houses of great chiefs—the si-vane—who ruled over Elder Brother’s people, a hapless peasantry. These early researchers also presumed that this feudal Indian society lasted only a few hundred years, placing the downfall of the si-vane into the recent past when Padre Kino visited the region.

Two decades passed before the Hohokam again became subjects of archaeology. A new wave of researchers, whose impact was felt beginning in the mid-1920s, viewed the Cushing-Fewkes reconstructions of Classic native society as unbridled speculation. Suddenly, a reliance on Indian legends was regarded as unscientific, and questions about the nature of a prehistoric society were viewed as unanswerable. Priorities shifted to questions of chronology and culture sequence, as archaeologists

(Left, above) These Sacaton Red-on-buff (A.D. 900-1100) effigy vessels portray mountain sheep, a common Hohokam decorative motif that appeared both in ceramics and on rock art. Height of both vessels, ca. 17 centimeters. (Left, below) A selection of Hohokam pottery from the Snaketown site exhibits the range of forms and designs typical of the Colonial period (A.D. 550-800). Length of ceramic box, 22 centimeters.

stressed the gathering and cautious interpretation of physical remains.

The 1920s also witnessed the introduction of new archaeological techniques such as stratigraphy and tree-ring dating. Stratigraphic excavations demonstrated that the structures Cushing and Fewkes had discovered were not all contemporaneous: pithouses dated earlier than the compounds and great houses. The perfection of tree-ring dating, or dendrochronology, in 1929 allowed the ruins and pottery types of northern Arizona and New Mexico to be dated with uncanny accuracy. And fortunately, some of these very same ceramic types were discovered as trade goods in southern Arizona, clearly indicating that Hohokam sites were far older than just a few hundred years. By the early 1930s, archaeologists learned that the Casa Grande was built in the fourteenth century, and other Hohokam sites were of even greater antiquity. It was even more important now to define the cultural sequence preceding the Classic period. Si-vane, Elder Brother and the Classic period were forgotten until the early 1970s.

Most of the revelations about the Hohokam sequence resulted from the work of Harold S. Gladwin and Emil W. Haury. Gladwin, whose interest in archaeology had been sparked by his acquaintance with A. V. Kidder, the foremost southwestern archaeologist of the time, sold his seat on the New York Stock Exchange and moved west, establishing a foundation for archaeological research in 1928. Built on the remnants of a fourteenth-century ruin, the Gila Pueblo Foundation in Globe, Arizona played a leading role in southwestern archaeology and was the main focus of Hohokam research for a decade. One of Gladwin’s first employees in fact was a young graduate of the University of Arizona, Emil W. Haury, who went on to become Director of the Arizona State Museum and head of the Department of Anthropology at the University of Arizona.

In order to define how much land the Hohokam occupied and especially to search for their origin, Gladwin dispatched survey crews to the distant corners of the Southwest, from southern California to Texas and Chihuahua in Mexico, seeking the distinctive red-on-buff pottery that marked Hohokam sites. The Gila Pueblo surveys corroborated the existence of two pre-Classic periods, the so-called Colonial and Sedentary, which Gladwin himself had set up on the basis of stratigraphic tests in the vicinity of the Casa Grande during 1926. In Gladwin’s view, however, the earliest known period—the Colonial—was too advanced in ceramics and other arts to represent the original Hohokam. Yet despite their unprecedented coverage the Gila Pueblo surveys failed to disclose a suitable progenitor for the Hohokam. Reluctantly, Gladwin decided to concentrate the search for the elusive earlier “Pioneer” period in the Hohokam heartland of the Gila and Salt rivers.

In 1934 Emil Haury and his Gila Pueblo co-workers began excavations at the site of Snaketown, a large pre-Classic ruin on the Gila River just south of Phoenix. Relatively undisturbed deposits and dozens of prominent trash mounds there



Hohokam artisans of the Colonial period applied dynamic geometric, anthropomorphic and zoomorphic designs to their pottery. These two Santa Cruz Red-on-buff jars are from the Snaketown site. Height of tall jar in background, ca. 30 centimeters.

promised to reveal a long sequence of Hohokam development. Within the first few weeks of field-work, the Gila Pueblo staff had uncovered indisputable ceramic evidence of the Pioneer period, culminating in a sequence for the Hohokam — Pioneer, Colonial, Sedentary, and Classic. Unfortunately, there were few intrusive sherds at Snaketown that could be used for dating the actual beginning of the Pioneer period, although by assuming a constant rate of ceramic change Gladwin and Haury made the reasonable guess of 300 B.C.

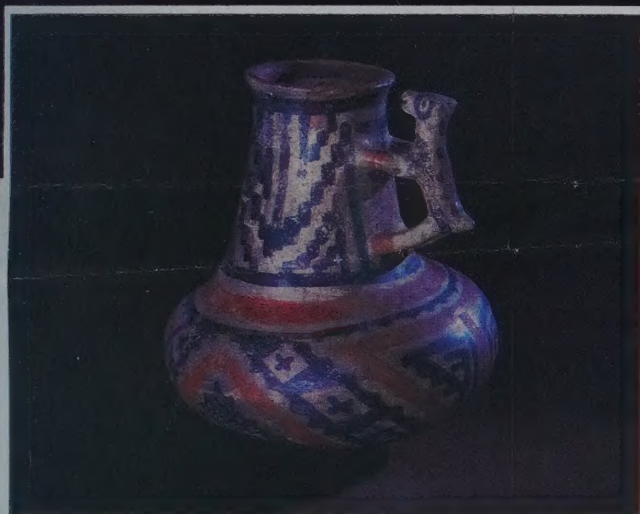
In the decades following the 1938 publication of the Snaketown findings, numerous investigators, including Gladwin himself, challenged the distinctiveness of the Hohokam periods and their dating. To resolve these controversies, Haury returned to Snaketown in 1964-5. The results of his extensive excavations validated the original ordering of the periods and their constituent phases. Regrettably, he still did not succeed in determining exactly when the Hohokam sequence began.

The Pioneer period is in many ways the least understood, and most claims regarding it are controversial. Estimates for its appearance range from the original 300 B.C., still supported by Haury, to Schiffer's A.D. 500 which rests on the interpretation of Hohokam radiocarbon dates.

Haury believes that the Pioneer Hohokam were immigrants from northern Mexico who settled in the Gila-Salt Basin, while others suggest that the Hohokam evolved in place from Archaic hunting-gathering groups. Some archaeologists assume that the Pioneer folk were farmers who irrigated their crops with canal-drawn water. Others argue that agricultural products contributed few calories to the diet. Despite these disagreements, which stem partly from a paucity of known and excavated sites, it is clear that the Pioneer period Indians established a basic cultural pattern.

Pioneer villages were small—at most several dozen roughly rectangular pithouses—and widely scattered, principally along the Gila and Salt rivers. Subsistence pursuits included gathering wild plant products such as mesquite beans, hunting, and growing domesticated plants, including corn, beans and squash. By the end of the period, the Hohokam utilized shallow, relatively short canals to water their fields. And when someone died, relatives cremated the body and buried the ashes with ceremoniously shattered ceramic vessels in trenches or pits. Their pottery was gray to buff, occasionally slipped orange-red or decorated with blood-red paint.

During the aptly named Colonial period, which began sometime between A.D. 550-800 and persisted until A.D. 900-1000, Hohokam artifacts spread over a substantial part of Arizona. Whether this expansion actually came about by colonists moving into outlying areas, or whether Hohokam



(Above) During the Sacaton period (A.D. 900-1100), the Hohokam manufactured large painted jars with a Gila shoulder, a low sharp step in the wall of the vessel. Diameter of jar in foreground, 33 centimeters. (Left) Tonto Polychrome (A.D. 1350-1450) vessels, a variant of Gila Polychrome, are most often jars, although the effigy handle on this example is uncommon. Height, 19.5 centimeters.

lifeways and material culture were accepted by indigenous populations is still a matter of debate. Regardless of the exact distribution process, Hohokam artifacts are found from the Mexican border north to Flagstaff and from Gila Bend east to Safford. Several elements were added to the Hohokam cultural pattern in the Colonial period, most notably ballcourts. Oval in shape and dug into the ground with earthen banks on each side, they vary greatly in size; smaller courts are only 20 meters or so in length, while the largest could enclose a football field. The function of these ballcourts, as might be expected, is disputed. Some believe that they were used for playing a Mesoamerican-style ball game; one can also find champions of a dance court interpretation. Adding fuel to the argument was the discovery of two pre-Spanish balls made of native rubber in southern Arizona, but unfortunately not in association with ballcourts.

Most changes of the Colonial period were mainly

elaborations of Pioneer themes. House shape went from rectangular to oval, but the brush and mud superstructure was retained. Ceramic decoration, stone carving and shell jewelry made from shells originating at the Gulf of California displayed greater sophistication in technique and design. The Hohokam became shell merchants, trading jewelry to other Indian societies in northern Arizona and New Mexico. And by the end of the Colonial period, most central and southern Arizona valleys were dotted with Hohokam agricultural settlements and canals.

Trends initiated in the Pioneer and Colonial periods continued in the Sedentary period, beginning A.D. 900-1000 and ending around A.D. 1150. Longer canals as well as larger and more numerous villages testify to population growth and probably a considerable dependence on agriculture. Trade expanded with societies to the north and south. Specialized villages between the Gila River and the Gulf of California procured marine shell and worked it into jewelry that was traded north as far as Flagstaff. More exotic goods, copper bells, parrots, and iron pyrite mirrors were brought in from Mexico. In non-Hohokam villages near Flagstaff

and on the present San Carlos Apache Reservation, isolated Hohokam-style houses and ballcourts appeared. These have been interpreted as Hohokam outposts associated with the shell trade.

It is striking how much the Classic period departed from the orderly development of the Hohokam seen in the earlier periods. The most obvious changes took place in their architecture. Pithouses were no longer the major type of dwelling. Contiguous rectangular rooms of adobe were built instead, often arranged around plazas that were walled to form compounds. Villages usually contained several compounds, one of which was often built on a large flat-topped platform mound. Multi-storied great houses also appeared, the Casa Grande being the best preserved example. Expanded canal systems were further refined and carried water for distances up to 32 kilometers, forming large networks of interconnected villages.

Craft arts and burial practices also underwent marked changes. Early in the Classic, red-on-buff decorated types declined in popularity and were replaced by polished red vessels. Later, the dominant decorated ware became Gila Polychrome, which originated in the Tonto-Lake Roosevelt area near Globe, Arizona. Gila Polychrome is slipped red with black and white painted decorations, primarily on the interior of bowls.

Greater standardization in technique and simplification are evident in the shell and stone artifacts. Cremation, which had been the prevalent mode for disposing of the dead, decreased in popularity. By the end of the Classic, the Hohokam had accepted the then widespread southwestern practice of burial in an extended position.

Even the distribution of Classic settlements differed from preceding periods. Although there was a decline in the overall territory occupied by the Hohokam as some northern frontiers were abandoned, the number of villages in the Gila-Salt Basin actually increased, and represented one of the two or three densest concentrations of people north of Mexico. The population of the Salt River Valley may have exceeded 20,000 persons—a figure that was not reached again until this century. Unlike earlier periods, when villages were confined to the first and second river terraces, the extensive canal systems allowed settlements to move considerable distances away from the rivers. In fact, the largest Classic village, Los Muertos, lay ten to 16 canal kilometers from the Salt, and included more than 100 compounds spread over an area of about 20 square kilometers.

For stockbroker-turned-archaeologist Gladwin and Emil Haury, the Classic seemed too divergent to be Hohokam. They proposed that Salado groups to the northeast, makers of Gila Polychrome, had invaded Hohokam territory and introduced the hallmarks of this period—rectangular adobe rooms, platform mounds, polychrome pottery, and extended burials. The Hohokam probably did not leave the area, according to Gladwin and Haury, but coexisted with the more progressive Salado. When these intruders left at the end of the Classic pe-

riod, concludes this scenario, the Hohokam reverted to their former simpler way of life, eventually becoming the Pima who led Padre Kino to the Casa Grande.

Neither Gladwin nor Haury speculated greatly on the character of Classic Hohokam social organization. Although they did not accept the Pima legends as historical fact, both men were influenced nonetheless by the historic Pimas. Haury especially saw little need to postulate a prehistoric society more complex than the Pimas. To these archaeologists, the Classic Hohokam were tribal agriculturalists who incidentally built massive canal systems and monumental architecture. The Classic period differences amounted to nothing more than the stylistic preferences of another group—the Salado.

This view prevailed until the 1960s and early 1970s when new evidence suggested that the Classic period could in fact be linked with an orderly development within the Hohokam tradition. The first clues were found in the Gila Bend area, when William Wasley and Alfred Johnson, then of the Arizona State Museum, discovered a Sedentary period platform mound at the Gatlin site. Inspired by the findings there, Wasley argued that the traits of the Classic period—inhumation, redware pottery, above-ground architecture, and platform mounds—were indigenous Hohokam developments. Haury's reexcavation of Snaketown added more ammunition—a sequence of mounds beginning in the Colonial period. Both excavations also yielded evidence of Sedentary plazas surrounded by houses. Another important piece of the puzzle was found at Las Colinas where investigations by Laurens Hammack, also then of the Arizona State Museum, uncovered a complex mound that indisputably linked the Sedentary and Classic periods. Other projects disclosed that the switch from pithouses to contiguous adobe rooms happened gradually and was marked by many transitional house forms. Finally, a Sedentary canal as large as any seen during the Classic was found in Phoenix.

These discoveries suggest that the Classic was an outgrowth of the previous Hohokam periods and not the result of a foreign intrusion. Although population movements may have occurred at the beginning of the period, they cannot account for all the phenomena of the Classic. Recently, researchers David Wilcox of the Arizona State Museum and Martin McAlister of the Tonto National Forest have resurrected the ideas of Cushing and Fewkes, and proposed that the Classic period represents a society more complex than the historic Pimas, perhaps a chiefdom or a state. Indeed, it has become apparent that the Classic includes many features, such as an extensive irrigation system, incipient urbanism, craft specialization, monumental architecture, and increased social stratification, all normally associated with civilizations.

For one thing, the evidence for craft specialization already appears in the Sedentary period—perhaps earlier—and continues into the Classic. The large numbers of elaborate, exquisitely chipped projectile points recovered from cremations led the late flint-knapping authority Don Crabtree to

conclude that these points were chipped by specialists. Similarly, production of ceramics by specialists is hinted at by pottery manufacturing areas, increasingly standardized forms and decoration, and extensive quarries for mica temper. Such specialization seems to continue into the Classic period as the designs of pottery, shell jewelry and stone artifacts become more standardized.

The Hohokam built their most enduring monument, the four-story Casa Grande, around A.D. 1350, probably in a major burst of building activity. The most recent interpretations suggest that this structure was multi-purpose, serving as an elite residence, perhaps a storehouse, and an observatory. In fact, there are several "observation holes" in the building through which celestial events of interest to an agricultural people, such as the summer and winter solstices, could be tracked.

Society also grew more complex as variations in the compounds and villages suggest. Obviously their occupants differed in wealth, power and lifestyle. At Escalante, a village only a few miles from the Casa Grande, most individuals lived in compounds consisting of several living and storage rooms arranged around a plaza. Not all compounds, however, were equal in their labor investment; usually at least one rested two to three meters above the others on a large platform mound. In addition, not all villages were equivalent. The main village at the Casa Grande contrasts sharply with Escalante. The great house itself is a huge residence built atop a platform mound, and at least one other multi-storied building existed. Casa Grande appears to have been an administrative and religious center housing an elite that may have controlled numerous villages like Escalante. Los Muertos was perhaps a similar center. On the basis of just such differences, archaeologists have made the case that Classic society consisted of elites and peasants. Villages may have been governed by local elites, while suites of villages, perhaps those located on the same canal system, fell under the jurisdiction of a principal village. Future studies may help to determine if there was a paramount authority—perhaps at Casa Grande or Los Muertos—for an entire river valley or even the Gila-Salt Basin.

The rise and fall of the Hohokam presents an intriguing case for students of civilization to ponder. The Hohokam archaeological sequence encompasses an evolutionary development of increasing complexity, culminating in the trappings of a complex society. Like all early civilizations, the Hohokam underwent a process of growth—more and larger settlements, a greater variety of artifacts and types of architecture, and integration of villages into ever larger regional systems. Somewhere along the line, however, the Hohokam stalled on the path to civilization. A considerable gulf still separates Classic Hohokam society from what is usually considered "civilization." Although a few village-size colonies may have been established, the Hohokam possessed no farflung empire. They were artisans and traders, but with the conspicuous exception of shell, most of their craft items are not found outside the Gila-Salt Basin. Foreign

trade objects are also scarce. And other hallmarks of civilization, such as a writing system, cities, and standing armies, seem to be absent.

When Lieutenant Manje first heard of "casas grandes," the Hohokam were the stuff of legends. Their majestic villages along the Salt and Gila stood empty. And the probable descendants of the Hohokam—the unassuming Pima—lived in modest pithouse villages, much like their ancestors a millennium before. Floods and drought, revolution, population pressures, political upheavals in Mexico, and salinization of fields are among the explanations espoused by archaeologists for the decline of the Hohokam. Although all of these hypotheses have champions, even today the causes of the Hohokam collapse remain elusive. If archaeologists could identify the reasons why the Hohokam and many other societies around the world could not sustain growth, then perhaps we would be closer to explaining why a few societies *did* reach civilization.

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Empires, Capitals and Landscapes of Ancient Ethiopia

by KARL W. BUTZER

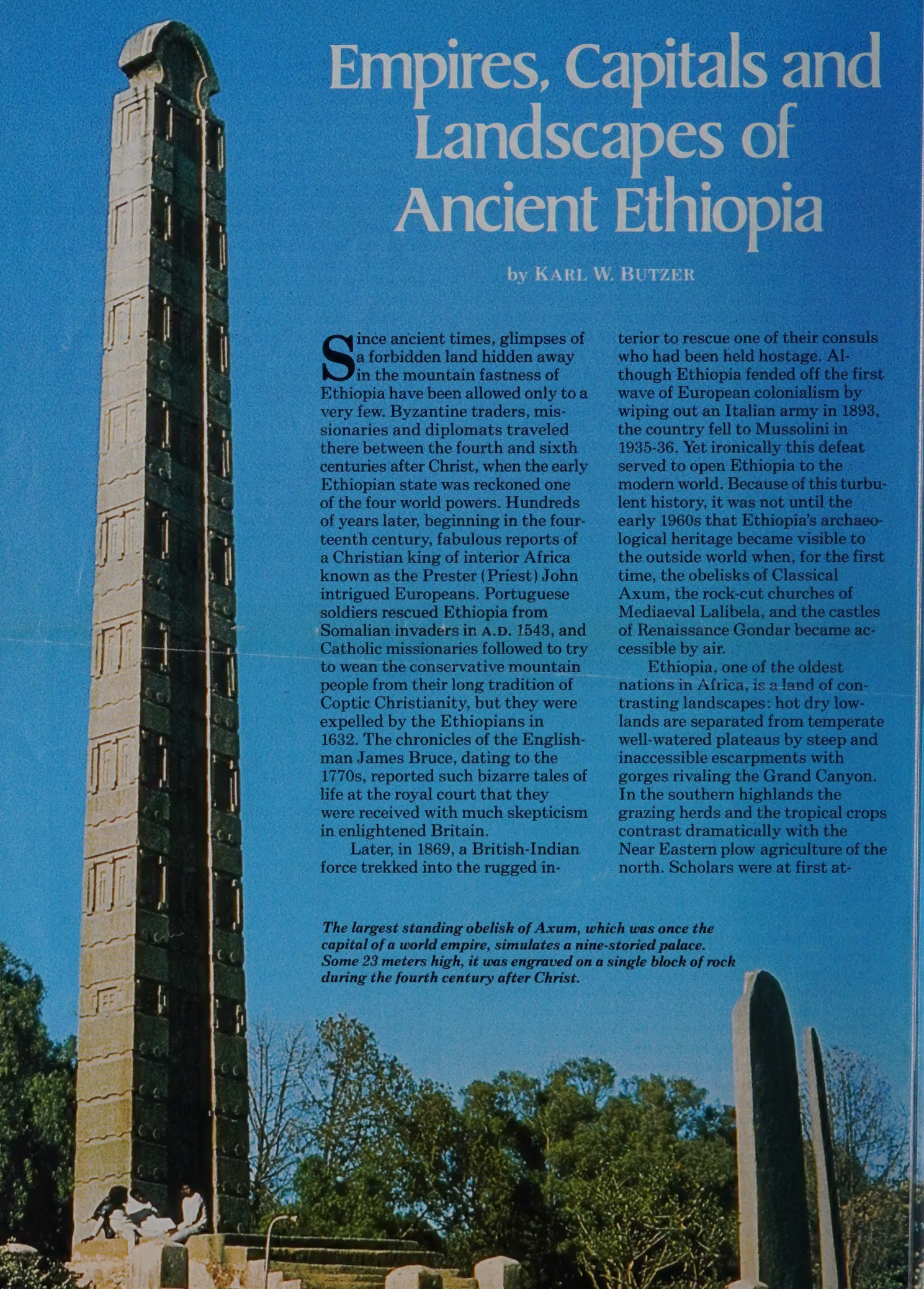
Since ancient times, glimpses of a forbidden land hidden away in the mountain fastness of Ethiopia have been allowed only to a very few. Byzantine traders, missionaries and diplomats traveled there between the fourth and sixth centuries after Christ, when the early Ethiopian state was reckoned one of the four world powers. Hundreds of years later, beginning in the fourteenth century, fabulous reports of a Christian king of interior Africa known as the Prester (Priest) John intrigued Europeans. Portuguese soldiers rescued Ethiopia from Somalian invaders in A.D. 1543, and Catholic missionaries followed to try to wean the conservative mountain people from their long tradition of Coptic Christianity, but they were expelled by the Ethiopians in 1632. The chronicles of the Englishman James Bruce, dating to the 1770s, reported such bizarre tales of life at the royal court that they were received with much skepticism in enlightened Britain.

Later, in 1869, a British-Indian force trekked into the rugged in-

terior to rescue one of their consuls who had been held hostage. Although Ethiopia fended off the first wave of European colonialism by wiping out an Italian army in 1893, the country fell to Mussolini in 1935-36. Yet ironically this defeat served to open Ethiopia to the modern world. Because of this turbulent history, it was not until the early 1960s that Ethiopia's archaeological heritage became visible to the outside world when, for the first time, the obelisks of Classical Axum, the rock-cut churches of Mediaeval Lalibela, and the castles of Renaissance Gondar became accessible by air.

Ethiopia, one of the oldest nations in Africa, is a land of contrasting landscapes: hot dry lowlands are separated from temperate well-watered plateaus by steep and inaccessible escarpments with gorges rivaling the Grand Canyon. In the southern highlands the grazing herds and the tropical crops contrast dramatically with the Near Eastern plow agriculture of the north. Scholars were at first at-

The largest standing obelisk of Axum, which was once the capital of a world empire, simulates a nine-storied palace. Some 23 meters high, it was engraved on a single block of rock during the fourth century after Christ.





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friendly nature of this sea, and the vulnerability of wooden sailing ships with primitive navigation—vessels constantly beset by warfare and piracy—thousands of ships were sunk or wrecked. Many have been salvaged or looted. Many more have been scattered across the bottom at unworkable depths. At the same time, hundreds remain to be found, researched and excavated.

However, the Caribbean is not an easy place for the nautical archeologist to work. The continental shelf in many places drops off to unworkable depths . . . many of the island governments are unreceptive, suspicious or antagonistic to exploration . . . suitable supply and research bases are few and far between . . . hurricanes occur during the summer months . . . artifacts and timbers become rapidly encrusted with coral . . . and the reefs themselves, in conjunction with the wind and currents, tend to tear up wrecks and scatter their parts over a wide area. Sharks are an ever-present—even if usually unfounded—source of unease. Piracy is not unknown, and the treasure-hunting

approach to wrecks is universal.

Despite these drawbacks, the Caribbean must be considered an essential place for nautical archeology to be carried out. A substantial effort should be made to help all of the countries there retain important parts of their national heritage by introducing proper methods of excavation and preservation. A case can even be made that the wrecks off their shores belong not only to the states themselves, but to all mankind. Governments in the Caribbean should be encouraged and helped to adopt this view.

It is sad when any country permits a valuable part of its historical heritage and patrimony to be used shabbily. Unfortunately, the degree of sophistication of governments varies. Sometimes greed enters into the equation, and the cause of scholarship is not well served.

What is needed by most governments in the islands—before the treasure-hunters, through ignorance, destroy what they find—is guidance and assistance in assessing and preserving their underwater resources, which often exist in greater scope and importance than those on land. Government officials in the Caribbean must be given a choice other than

the one most often available—turning wrecks over to members of the treasure-hunting fraternity, who take for themselves the lion's share of the finds. Instead, island governments must be given the opportunity to arrange for the meticulous archeological study of their wrecks, whereby they also retain everything that is found. The interpretive museums they could establish would serve not only citizens and tourists, but national pride and economies in the islands as well.

Some wrecks are more important historically than others, but the governments responsible for them should have the best advice and encouragement on how to proceed in granting permits for exploration and excavation. Without such guidance, the loss is not theirs alone, but ours too. ☸

Visit/continued from back cover

then on to the village itself.

The entire area is something of a micro-setting for a real village. In aboriginal times the site would be on a broader terrace, with larger gardens (three acres per family), along a larger stream such as the Des Moines or the Iowa rivers. There would be in excess of 100 lodges housing about 1,000 people. The "Ioway Village" is composed of two lodges, an "arbor" or sun shade, a sweat lodge, scalp pole, tripod for a medicine bundle, and several hearths and activity areas.

After an orientation, visitors can walk about the village and step inside the lodges. They are often amazed to learn that 50 elm trees would be cut to make a single lodge. The scalp pole is also a surprise. It is difficult for the average visitor to comprehend how different life in the area was only 100 years before the pioneer period, with which they identify more readily.

Interpretation at such a site provides several challenges. First, there is the fragmentary record of the lifestyle of the period. Second, there is a cultural barrier which makes it virtually impossible for individuals to fully "live" the history as they do at other farms. Third, the village and its contents are extremely perishable, requiring constant maintenance and care. But the staff of Living History Farms is meeting these challenges.

—Duane C. Anderson
Iowa State Archeologist

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*Fluted drills (actual size) from
a group of 60 discovered on
the Vail habitation site.*

Addendum

"The Archeology of Peppermint" which appeared in the Autumn, 1982, issue of *Early Man*, was based on "Essence of Peppermint, a History of the Medicine and its Bottle" by Olive R. Jones, in *Historical Archaeology*, Vol. 15, No. 2, 1981, pp. 1-57.

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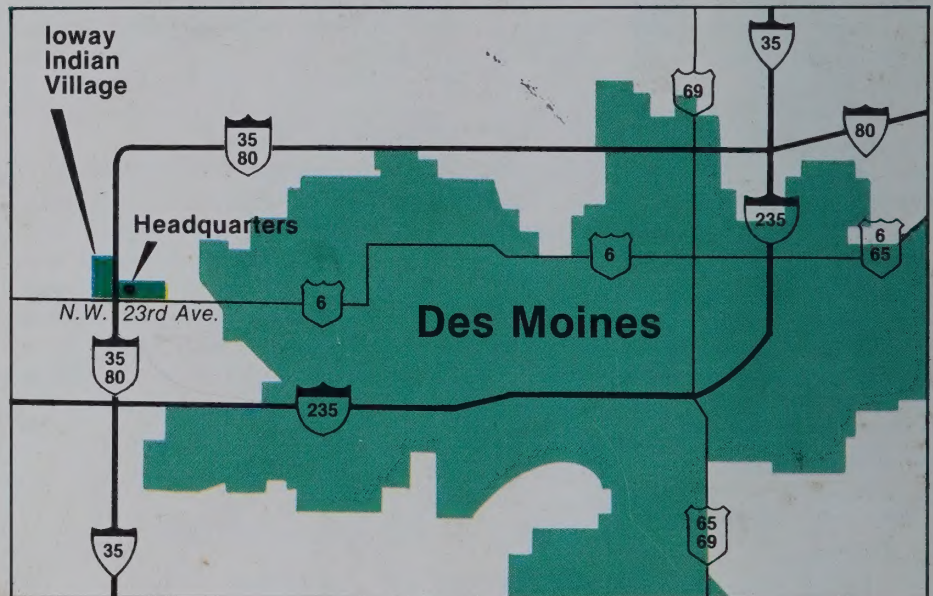
Reconstructed 1700s Ioway Village at Living History Farms

For many years Bill Murray, one of the founders of Living History Farms located within the environs of metropolitan Des Moines, was concerned that the interpretive program there did not include the contributions and lifestyle of ancient Native Americans. You could tour the "Pioneer Farm" and get an idea of what life was like in the 1850s. The same was true for half a century later at the "1900 Farm," and people of all ages were fascinated by the "Farm of Today and Tomorrow." The dramatic changes that have come about in little more than 150 years were all there to be experienced—even the animals looked different from farm to farm.

But Bill Murray was right. The fabric of life that existed in Iowa before 1850 unraveled in one's imagination. Nowhere in evidence were reminders, for example, that corn, beans, squash, tobacco and a host of other crops that are tremendously important today in sustaining human life were developed in the New World by Native American peoples.

This is no longer true, however. Bill Murray enlisted the aid of Gerry Schnepf, director of the Iowa Natural Heritage Foundation, and myself to establish an advisory committee of Indians, scientists, historians and naturalists to plan an aboriginal village. The committee elected to depict the lifestyle of the Ioway as this tribe existed in the state around A.D. 1700. To get the program off the ground, the committee drew up a grant proposal which ultimately was approved by the Iowa Humanities Board.

Historian Martha Blaine and archeologists Waldo and Mildred Wedel were engaged as subject matter consultants on Iowa ethnohistory and archeology. John White of the Center for American Archeology signed on to advise the committee on Native American technology. During 1981, the author went to the CAA's teaching and research center at Kampsville in southern Illinois to learn house construction and a variety of crafts, as well as to study John's "environmental approach" to reconstruction and replication projects.



Martha Blaine contacted a group of Ioway Indians living in Oklahoma and told them of our plans, seeking their advice and participation. The advisory committee held work days to begin restoring the site at Living History Farms to natural conditions (it had been a pasture). Ninety trees were planted, including species that would have had special uses to the Indians. Later in the spring of 1981, Dan Zwiener and his junior high students planted gardens. Dan had been collecting and raising many different varieties of Indian crops, and has distributed seeds and seed catalogs to teachers, students, museums, laymen and even groups of contemporary Indians.

Construction of the actual site got underway in late June with a crew consisting of the author, two graduate students from the University of Iowa, Dan Zwiener, two interns and several volunteers. The village was opened to the public after the first week, and we found dealing with up to 400 visitors a day both a blessing and a curse. People loved to see the flintknapping, house building, pottery making, and so on, but we had a difficult time getting our work finished.

For us archeologists it was a new experience. Usually, we take sites apart. This time we were putting one together, making

maximum use of aboriginal tools and techniques. However, we also learned things that could be applied archeologically, as we mapped and photographed our activity areas each time a task was completed.

In addition to the bark lodges and the garden plot, we constructed more than 130 artifacts: celts, adzes, rakes, hoes, digging sticks, a bow and arrows, pottery, milling stones, gaming pieces, wooden bowls, scrapers, drills, pipes and other items—all patterned after those documented for the Ioway tribe. We also bought beads, brass kettles, trade axes and iron knives similar to those obtained through trade with the French, and made gun flints resembling those of European origin that the Ioway traded for.

All of these items, along with garden produce and wild plants used for fiber, dye and food, are displayed throughout the village area to augment the interpretive program.

When visitors go through the Ioway village, they get off the tractor-drawn cart and walk a trail past the gardens. There they are met by an intern who tells them about the types of corn, beans and squash the Ioway raised. The path then goes past the sacred tobacco patch, on to a place in the stream where clay and cattails were collected, and

(Continued on page 45)